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DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY
CHARLES D. WALCOTT, DIRECTOR

MINERAL RESOURCES
OF THE
UNITED STATES

CALENDAR YEAR
1901

DAVID T. DAY
CHIEF OF DIVISION OF MINING AND MINERAL RESOURCES

WASHINGTON
GOVERNMENT PRINTING OFFICE
1902

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U. S. Geological Survey,
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LETTER OF TRANSMITTAL.

Department of the Interior,
United States Geological Survey,
Division of Mining and Mineral Resources,
Washington, D. C., September 8, 1902.

Sir: I have the honor to transmit herewith the report, Mineral Resources of the United States, Calendar Year 1901, being the eighteenth annual report of the series published by this office. Besides the statistics for the calendar year 1901, considerable descriptive and technical matter, obtained while the statistical canvass was in progress, is presented. All of this material has been given prompt publication as advance extras from the report, in accordance with the law providing for the printing of any chapter as soon as completed

In accordance with your instructions, the report for the calendar year 1902 is in preparation.

Very respectfully, your obedient servant,

David T. Day,
Geologist in Charge.

Hon. Charles D. Walcott,
Director of United States Geological Survey.

MINERAL RESOURCES OF THE UNITED STATES, 1901.

DAVID T. DAY, *Chief of Division.*

INTRODUCTION.

The arrangement and scope of this volume are practically the same as in the seventeen preceding reports of the series, Mineral Resources of the United States. Each report records the development of the mineral industries of the United States since the time covered by the preceding number of the series; the reports should therefore be consulted together. Every chapter in this report is a census of the productive features of the industry as complete as possible with the means at command. The statistics of the production of gold and silver have been prepared in conjunction with the Director of the Mint, Treasury Department. The statistics of the imports and exports of minerals, which form an essential part of the volume, are obtained through the courtesy of the Chief of the Bureau of Statistics, Treasury Department.

ACKNOWLEDGMENTS.

Except as noted above, and in a few isolated instances where some other well-established agency already exists by which the statistics are collected accurately, the figures are obtained directly from the producers, and it is impossible to acknowledge here, otherwise than by brief mention, the invaluable assistance which has been freely rendered by them and the voluntary contributions of many local experts. The names of the statistical experts who, acting under the authority of the United States, have collected statistics from the producers are given at the heads of the special chapters. The technical press, besides affording much information concerning new mining enterprises, has been largely drawn upon for prices, market reports, and new technical processes.

As heretofore, the publication of this volume has been anticipated to a great extent by the issuance in advance, in pamphlet form, of the several chapters which compose it. Before the issuance of this volume all of the chapters, except those treating of gold and silver and green sand marl, will have been so given to the public.

The following summary gives the principal statistical information recorded in this report:

In presenting these statistics all unnecessary duplication has been avoided. The coke product, discussed in the following pages, amounting to 21,795,883 short tons, valued at $44,445,923, is excluded from the tabulation, as the quantity and value of the coal used in its manufacture is included in the statistics of coal production. Similarly, white lead, red lead, and litharge, whose average aggregate value for the last ten years has exceeded $10,000,000, are not given in the table, the base from which they are made being included in the output of pig lead. Zinc oxide, or zinc white, made directly from the ores and consequently not included in spelter production, is tabulated. The production of pig iron and its value are given in the tabulation as the best means of presenting the statistics of production in the first marketable condition. The value of brick and pottery clays, rather than the value of the manufactured products, is embraced in the tabular statement, although the statistics of brick, tile, and pottery production are presented in detail in the report. Inflation of valuation and all unnecessary duplication are thus avoided.

SUMMARY OF THE MINERAL PRODUCTION OF THE UNITED STATES IN 1901.

GENERAL REMARKS.

The varied character of the units of measurement employed in the mineral industry makes it impossible to compare the outputs of the several minerals except in the value of the products. The figures given in the following summary show a continuation of the remarkable activity in the mineral industries of the United States noted in 1900.

In 1901, for the second time, the total value of our mineral production exceeded the enormous sum of $1,000,000,000, the exact figures being $1,086,529,521, as compared with $1,063,620,548 in 1900, and with $972,152,208 in 1899, a gain of 1901 over 1900 of $22,908,973, or 2.15 per cent, and a gain of 1901 over 1899 of $114,377,313, or 11.77 per cent. Although this gain is not so great either actually or proportionally as was the gain in 1899, when the gain over 1898 was $273,601,810, or 39.17 per cent, it is sufficient to show that the growth of the mineral industries keeps pace with the national prosperity.

The notable gains and losses of the last two decades are as follows:

The largest actual gain was that of 1899 over 1898, $273,601,810, or 39.17 per cent; next that of 1900 over 1899, $91,468,340, or 9.41 per cent; then the gain of 1895 over 1894, which was $94,215,822, or 17.88 per cent, and the gain of 1887 over 1886, $74,927,880, or 16.81 per cent. In other years than those mentioned between 1880 and 1898 the gains were not noteworthy, and in some of the years, notably in 1884, the production decreased $40,451,968, or nearly 9 per cent. During the industrial depression of 1892–1895 the production would have been expected to decline, as it did, going from $648,895,031 in 1892 to $574,464,724 in 1893; to $527,079,225 in 1894, and then rising to $621,295,047 in 1895, and not reaching the output of 1892 until 1898.

As heretofore, iron and coal are the most important of our mineral products. The value of the former in 1901 was $242,174,000 and of the latter $348,910,469. All of the important metals decreased in both output and value, with the exception of the production of pig iron and zinc, and among the less important metals the most remarkable increase both in quantity and value was made in platinum: 1,408 ounces valued at $27,526, as compared with 400 ounces valued at $2,500 in 1900, a gain of 1,001 per cent in value. The fuels increased from $406,359,351 in 1900 to $442,395,304 in 1901, a gain of $36,035,953, or 8.87 per cent. Every variety of fuel increased in value except petroleum, which showed an increase in quantity of 5,768,665 barrels, but a decline in value of $9,571,978, due largely to the less valuable character of the increased product of the new petroleum fields as compared with the older fields. Anthracite coal increased 9,021,207 long tons in output and $26,746,169 in value. The average price of anthracite coal per ton at the mine was $2.05, the highest figure obtained since 1888, as compared with $1.85 in 1900 and $1.80 in 1899; and the average price per ton for bituminous coal at the mine was $1.047, about the same as in 1900.

The gain of $22,908,973 is due entirely to the increase in the nonmetallic products, since the metallic products showed a decline from $550,425,286 in 1900 to $518,268,377 in 1901, a loss of $32,156,909, whereas the nonmetallic products increased from $512,195,262 in 1900 to $567,261,144 in 1901, a gain of $55,065,882. To these products should be added estimated unspecified products, including the rare minerals, lithium, tungsten, vanadium, uranium, etc., bismuth and crystalline quartz, valued at $1,000,000, making the total mineral production for 1901 $1,086,529,521.

For the first time since 1885 the production of bismuth in the United States is noted in this report. The manufacture of arsenious oxide was, for the first time in the United States, in 1901, taken up by the Puget Sound Reduction Company at Seattle, Wash., when an output of 300 short tons was placed on the market. For the first time also, in 1901, the production of rutile on a large scale was realized by the American Rutile Company from the deposits in Nelson County, Va., whose output amounted to about 40,000 pounds.

METALS.

Iron and steel.—The record-breaking output of pig iron in 1899, 13,620,703 long tons, valued at $245,172,654, which was exceeded in 1900, the output being 13,789,242 long tons, valued at $259,944,000, has again been exceeded by the production of 1901, which was 15,878,354 long tons, valued at $242,174,000. This is an increase of 2,089,112 long tons, or 15.15 per cent, in production, and a decline of $17,770,000 in value, or 6.84 per cent, as compared with 1900. In 1899 the production increased 15.69 per cent and the value increased 110.35 per cent over 1898. The average price per ton of pig iron increased from $18 in 1899 to $18.85 in 1900, and the price in 1901 was $15.25. The maximum price so far is $19, which was reached in 1887. The average price per long ton in recent years has been as follows: 1897, $9.85; 1896, $10.47; 1895, $11.14; 1894, $9.76; 1893, $11.90.

Iron ores.—The production of iron ores in the United States during 1901 amounted to 28,887,479 long tons, as compared with 27,553,161 long tons in 1900, a gain of 1,334,318 long tons, or 5 per cent, as compared with a gain of 12 per cent in 1900 over 1899. The total value at the mines of the ore mined in 1901 was $49,256,245, or a mean value of $1.71 per ton, an apparent decrease of 71 cents, or 29 per cent, from the 1900 figures of $2.42 per ton. The total value of the iron ore mined in 1901 shows a decrease of 26 per cent as compared with the total value, $66,590,504, of the ore produced in 1900. As in 1898, 1899, and 1900, the production of iron ores in 1901 has never been equaled by any other country, the nearest approach to our output being in 1900 by the German Empire, when 18,664,772 long tons were produced.

Copper.—The activity of 1899 and 1900 in the copper industry showed a slight falling off during 1901. The production decreased from 606,117,166 pounds in 1900 to 602,072,519 pounds in 1901, a loss of 4,044,647 pounds, or 0.67 per cent, as compared with an increase of 6.59 per cent in 1900; and the value decreased from $98,494,039 in 1900 to $87,300,515 in 1901, a decrease of $11,193,524, or 11.36 per cent, over 1900.

Lead.—The large increase in the production of lead in 1900 over 1899 was not repeated in 1901, the production of 270,700 short tons in 1901 being 124 short tons less than in 1900, and the value of the product, $23,280,200, being $281,488 less than in 1900.

Zinc.—The production of zinc in 1901 showed a marked increase in quantity over both 1900 and 1899; and the value of the product in 1901 shows an increase as compared with 1900 and a decrease as compared with 1899. The production in 1901 amounted to 140,822 short tons, as compared with 123,886 short tons in 1900; an increase of 16,936 short tons, or over 13 per cent, as compared with 1900, and an increase of 11,771 short tons, or 9 per cent, over 1899. The value of the zinc product in 1901 was $11,265,760, as compared with $10,654,196 in 1900 and with $14,840,865 in 1899.

Gold.—The gold production decreased in 1901, falling from 3,829,897 fine ounces in 1900 to 3,805,500 fine ounces in 1901; and the value decreased from $79,171,000 in 1900 to $78,666,700 in 1901. The decrease was due to the decline in production in Alaska and Colorado. In 1899 the production was valued at $71,053,400.

Silver.—The coining value of the silver production in 1901 was $71,387,800, as compared with $74,533,495 in 1900. The production in 1901 was 55,214,000 fine ounces, as compared with 57,647,000 fine ounces in 1900. The commercial value of the production of 1901 was

$33,128,400, as compared with $35,741,140 in 1900, a decrease of $2,612,740, or 7.31 per cent.

Quicksilver.—The production of quicksilver in 1901 showed an increase of 1,410 flasks of 76½ pounds net over 1900, or 29,727 flasks, as against 28,317 flasks in 1900. The production of 1901 was still 727 flasks below the production of 30,454 flasks in 1899. The value of the quicksilver produced in 1901, $1,382,305, exceeded in value $79,719 the output of 1900, and fell below the production of 1899 in value by $70,440.

Aluminum.—The Pittsburg Reduction Company, operating under the Hall patents, continues to be the only producer of metallic aluminum in the United States. The production in 1901 was 7,150,000 pounds, the same as in 1900, and exceeded by 650,000 pounds the production of 1899, and the value of the product of 1901, $2,238,000, increased $318,000 over that of 1900 and $522,000 over that of 1899.

Antimony—The amount of antimony obtained from ores of domestic production in 1901 was 50 short tons, valued at $10,250; the antimony obtained from the smelting of foreign imported ores was 364 short tons, valued at 74,620, and the antimony obtained from hard or antimonial lead produced from foreign and domestic lead ores was 2,235 short tons, valued at $457,150, a total production for 1901 of 2,649 short tons, valued at $542,020. The estimated total amount of antimony available for consumption in 1901 was 4,486 short tons, including 1,837 short tons of imported antimony regulus, as compared with 6,053 short tons, including 1,827 short tons of imported antimony regulus, in 1900. The decrease in the total quantity of antimony estimated to have been consumed in the United States in 1901, as compared with 1900, was due to the large overimportation of antimony ore, and, to a less extent, of antimony regulus in 1900.

Manganese ores.—The production of manganese ores increased slightly from 11,771 long tons, valued at $100,289, in 1900, to 11,995 long tons, valued at $116,722, in 1901, an increase in quantity of 224 tons, or almost 2 per cent, and in value of $16,433, or over 16 per cent. The average price per ton was $9.73, as compared with $8.52 in 1900 and $8.28 in 1899.

Nickel.—The production of nickel continued to decline from 22,541 pounds in 1899 to 9,715 pounds in 1900 and to 6,700 pounds in 1901. The value of the product decreased from $8,566 in 1899 to $3,886 in 1900 and to $3,551 in 1901. As heretofore noted, all of the domestic product was obtained as a by-product in the smelting of lead ores at Mine La Motte, Mo.

Platinum.—The production of crude platinum in 1901 showed a remarkable increase, although the amount produced still remains small. In 1901 the production was 1,408 ounces, as compared with 400 ounces in 1900, 300 ounces in 1899, 225 ounces in 1898, and 150 ounces in 1897, an increase for 1901 over 1900 of 1,008 ounces, or about 252 per cent. The value of the product obtained in 1901 was $27,526, as compared with $2,500 for 1900 and with $1,800 in 1899, an increase of $25,026, or 1,001 per cent, of the 1901 product over that of 1900.

Bismuth.—The production of bismuth ore in the United States in 1901 amounted to 318.6 short tons, as compared with 220 short tons in 1900. Colorado supplied the entire output. All of the ore contained gold and silver values, for which the producers were paid. As nearly as can be ascertained, the value of the product was $25,488, or an average of $80 per ton, charges for transportation and treatment being deducted.

FUELS.

Coal.—The aggregate production of anthracite and bituminous coal in the United States in 1901 amounted to 293,298,516 short tons, valued at $348,910,469, as compared with 269,682,827 short tons, valued at $306,671,364, in 1900, an increase of 23,615,689 short tons, or 8.76 per cent, in quantity, and of $42,239,105, or 13.8 per cent, in value.

The increase in 1900 over 1899 was 15,942,835 short tons in quantity and $50,593,930 in value.

The production of Pennsylvania anthracite showed a phenomenal increase from 51,221,353 long tons, or 57,367,915 short tons, in 1900 to 60,242,560 long tons, or 67,471,667 short tons, in 1901. This represented a gain of 17.5 per cent, the largest percentage of gain made by the anthracite trade in twenty years. Part of this increase in 1901 was due to the decreased output of anthracite in 1900 as compared with 1899, as, owing to the historic strike of 1900, the output of that year was reduced by over 2,500,000 long tons. The production of 1901 shows an increase over 1899 of 6,297,913 long tons, and but for the strike of 1900 would have shown an increase over that year of 4,500,000 long tons, or about half the increase actually made. The increase in the value of the anthracite product is still more striking, the amount received at the mines in 1901 showing a gain of $26,746,169, or more than 31 per cent, over that of 1900. The average price for the marketed anthracite coal (exclusive of the colliery consumption, which amounted to about 10 per cent of the total) was $2.05, the highest figure obtained since 1888. The production of bituminous coal, lignite, cannel coal, etc., including small amounts of anthracite from Colorado and New Mexico, increased from 212,314,912 short tons in 1900 to 225,826,849 short tons in 1901, a gain of 13,511,937 tons, or about 6 per cent. The value of this product amounted to $236,406,449 as compared with $220,913,513 in 1900, an increase of $15,492,936, or a little more than 7 per cent. The price of the bituminous product did not show any material advance in 1901, the average price being about 0.8 per cent higher than in 1900. The preliminary report issued by the inspectors of mines for Great Britain shows that the production of coal in the United Kingdom last year was 219,046,945 long tons, a decrease of 6,134,355 long tons from 1900. Reducing the production of the United States to the same unit, we find that it amounted to 261,873,675 long tons, 42,826,730 long tons (nearly 20 per cent) more than that of Great Britain. The coal output of her colonies, dependencies, including India, aggregated in 1900 about 17,000,000 long tons, so taking all of the British Empire as one producer, it still falls short of the coal production of the United States in 1901 by over 20,000,000 long tons.

Our coal production last year was nearly 75 per cent larger than that of Germany's, nearly seven times that of Austria-Hungary, and more than eight times that of France.

Coke.—The total production of coke in the United States in 1901, including the output from 1,165 retort or by-product ovens, was 21,795,883 short tons, valued at $44,445,923, as compared with 20,533,348 short tons, valued at $47,443,331, in 1900, and 19,668,569 short tons, valued at $34,670,417, in 1899. The increase in production in 1901 over 1900 was 1,262,535 short tons, or 6.15 per cent; the value of the product, however, showed a decrease of $2,997,408, or 6.3 per cent.

Petroleum.—The total production of crude petroleum in the United States in 1901 was 69,389,194 barrels, being larger than that of any previous year. It was larger by 5,768,665 barrels, or 9 per cent, than the production of the year 1900. The increase in the production of 1900 over 1899 was 6,549,679 barrels, or 11 per cent, and the increase in 1899 over 1898 was 3 per cent, or an average gain of 7.7 per cent for the last three years. The value of the product in 1901 was $66,417,335 as compared with $75,989,313 in 1900, a decrease of $9,571,978, or about 12.6 per cent. The largest number of barrels marketed in the States outside of the Appalachian and the Lima-Indiana fields was in California, although when the proportionate quantity produced though not sold is considered the State of Texas takes precedence. The gain in new production from these two States alone shows over 8,000,000 barrels, and when the increased yield in Kansas and Colorado is added the percentage of the total petroleum produced outside of the older fields above named is shown to rise from 8.60 per cent in 1900 to nearly 20 per cent in 1901. This is a difference of 11.40 per cent, and indicates that a rapid change is taking place in the localities from which the increased supply of petroleum is to be secured in the future. The quality of the petroleum produced from these new sections is generally much inferior to that produced in the older fields, the quantity of first-class illuminating oil and other valuable derivatives being very much less. The greater part, however, is valuable as fuel in its natural state, or after some of the more volatile products have been removed, and is particularly acceptable as such in the absence of deposits of coal in the Southwest and West. The average price per barrel for all the petroleum marketed in the United States during 1901 was 95.7 cents as compared with $1.194 in 1900, $1.132 in 1899, and $0.798 in 1898.

This is a decrease as compared with 1900 of $0.237 per barrel, the lowest average price since 1898. A noteworthy feature of the year, due particularly to the oil excitement in Texas and California, is the formation of 1,578 oil companies with an acknowledged and estimated capitalization of $669,083,000.

Natural gas.—The value of the natural gas product increased in 1901 to $27,067,500 as compared with $23,698,674 in 1900 and with $20,074,873 in 1899. This is a gain of $3,368,826, or 14 per cent in 1901 over 1900.

STRUCTURAL MATERIALS.

Stone.—The value of all kinds of building stone produced in the United States during 1901 amounted to $55,615,926 as compared with $44,321,345 in 1900 and with $44,090,670 in 1899, an increase of $11,294,581, or over 25 per cent in 1901 over 1900. The decline in exports of slate which was noted in this report for last year has continued. The value of the exports decreased from $1,363,617 in 1899 to $950,543 in 1900 and to $898,262 in 1901.

Clays.—The activity in all branches of the clay-working industries noted in the report as true of 1899 and 1900 has continued during 1901. The value of all clay products in 1901, as reported to this office, was $110,211,587 as compared with $96,212,345 for 1900, a gain of $13,999,242, or 14.55 per cent. The brick and tile products in 1901 were valued at $87,747,727 as compared with $76,413,775 in 1900, a gain of $11,333,952, or 14.83 per cent; the pottery products were valued in 1901 at $22,463,860 as compared with $19,798,570 in 1900, a gain of $2,665,290, or 13.46 per cent.

The clay mined and sold by those not manufacturing the product themselves in 1901 was valued at $2,576,932 as compared with clay valued at $1,840,377 sold in 1900.

Cement.—The total production of cement of all kinds in the United States in 1901 was 20,068,737 barrels, valued at $15,786,789, as compared with 17,231,150 barrels in 1900, valued at $13,283,581.

The Portland cement production in 1901 was 12,711,225 barrels, valued at $12,532,360 as compared with 8,482,020 barrels, valued at $9,280,525, in 1900, a gain of 4,229,205 barrels in quantity, or 50 per cent, while the value increased $3,251,835, or over 35 per cent. The number of plants producing Portland cement increased from 50 in 1900 to 56 in 1901.

The production of natural rock cement decreased from 8,383,519 barrels in 1900 to 7,084,823 barrels in 1901, a loss of 1,298,696, or over 15 per cent. The value decreased from $3,728,848 in 1900 to $3,056,278 in 1901, a loss of 18 per cent. The number of plants in operation in 1901 was 60 as compared with 64 in 1900.

The production of slag cement decreased from 365,611 barrels in 1900 to 272,689 barrels in 1901, while the value decreased from $274,208 in 1900 to $198,151 in 1901.

ABRASIVE MATERIALS.

Carborundum.—In 1901 the total production of carborundum was 3,838,175 pounds, worth from 8 to 10 cents a pound, as compared with 2,634,900 pounds in 1900, with 1,741,245 pounds in 1897, with 52,200 pounds in 1894, and with 15,200 pounds in 1893.

Corundum and emery.—The combined production of corundum and emery in 1901 amounted to 4,305 short tons, valued at $146,040, as compared with 4,305 short tons, valued at $102.715, in 1900, an increase in value of $43,325, or 42 per cent.

Crushed steel.—The production of crushed steel by the Pittsburg Crushed Steel Company in 1901 was 690,000 pounds, 10,000 pounds less than in 1900. Crushed steel is quoted on the market at 5½ cents per pound f. o. b. Pittsburg. The annual production has varied little since 1898.

Crystalline quartz.—The production of crystalline quartz in 1901 was 14,050 short tons, valued at $41,500, as compared with 14,461 tons, valued at $40,705, in 1900. The entire product was from Connecticut.

Garnet.—The amount of abrasive garnet produced in 1901 was 4,444 short tons, valued at $158,100, as compared with 3,185 short tons, valued at $123,475, in 1900, an increase in quantity of 1,259 tons, or about 40 per cent, and in value of $34,625, or about 28 per cent. The average value per ton in 1901 was $35.57 as compared with $38.76 in 1900. Until 1900 the North Carolina garnet was not included in these statistics.

Grindstones.—The production of grindstones of all kinds in 1901 increased in quantity and diminished in value, the total for 1901 being $580,703, as compared with $710,026 in 1900 and with $675,586 in 1899. The increase in the quantity of the production is due both to the domestic demand and to the growth of the export trade. The imports for 1901 amounted in value to $88,871, as compared with $92,581 in 1900. The increase in the domestic demand is due largely to the growth of the manufacture of agricultural machines.

Infusorial earth and tripoli.—The production of infusorial earth and tripoli increased from 3,615 tons, valued at $24,207, in 1900 to 4,020 short tons, valued at $52,950, in 1901, an increase of 405 tons, or over 11 per cent, in amount, and an increase in value of $28,743, or over 118 per cent. This increase in value is partly due to the large production of the American Tripoli Company, of Seneca, Mo.

Millstones and buhrstones.—The production of millstones in 1901 was valued at $57,179, as compared with $32,858 in 1900 and with $28,115 in 1899. The increase of 1901 over 1900 was $24,321, or a little over 74 per cent.

Oilstones and whetstones.—The value of the oilstones and whetstones made in the United States in 1901 amounted to $158,300, as compared with $174,087 in 1900 and $208,283 in 1899, a decrease in 1901 of $15,787, or 9 per cent. Compared with the production of 1899, which was the largest in the history of the industry, the decrease was $49,983, or 24 per cent.

CHEMICAL MATERIALS.

Arsenious oxide.—For the first time, during 1901, the manufacture of arsenious oxide was begun by the Puget Sound Reduction Company at Seattle, Wash., and an output of 300 short tons was placed on the market.

Borax.—The production of borax in 1901 consisted of 17,887 short tons of crude and 5,344 tons of refined, with a total value of $1,012,118, as compared with 24,235 tons of crude and 1,602 short tons of refined, valued at $1,018,251, in 1900.

Bromine.—The production of bromine in 1901 amounted to 552,043 pounds, valued at $154,572, as compared with 521,444 pounds, valued at $140,790, in 1900. The bromine is obtained from the mother liquor, made in the salt works in Michigan, Ohio, and West Virginia.

Fluorspar.—The total production of fluorspar in 1901 was 19,586 short tons, valued at $113,803, as compared with 18,450 tons, valued at $94,500, in 1900. The great increase in value was due to the larger amount of ground fluorspar sold and to the higher price obtained for it. The average price per ton of crude fluorspar was reported as $5, the same as in 1900. The average price per ton for ground fluorspar was reported as $9.03 in 1901, as compared with $5.66 in 1900.

Gypsum.—The production of gypsum, particularly for the manufacture of calcined plaster, continues to show a remarkable gain. The output of crude gypsum in 1901 amounted 659,659 short tons, valued, in its first marketable condition, at $1,577,493, as compared with 594,462 short tons, valued at $1,627,203, in 1900, an increase in quantity of 65,197 short tons, or 10.97 per cent, and a decrease in value of $49,710. The production in 1899 was 486,235 short tons and in 1898 it was 291,638 short tons. The greatly increased production of the last three years is attributable to the substitution of plaster of paris for ordinary lime mortar in the manufacture of wall plaster in large buildings; also to the manufacture of staff for temporary buildings.

Phosphate rock.—The production of phosphate rock decreased slightly, from 1,491,216 long tons in 1900 to 1,483,723 long tons in 1901, and the value decreased from $5,359,248 in 1900 to $5,316,403 in 1901.

Pyrite.—During 1901 the production of pyrite used in the manufacture of sulphuric acid was stimulated to the largest yearly quantity yet recorded, amounting to 234,825 long tons, valued at $1,024,449, as compared with the production during 1900 of 204,615 long tons, valued at $749,991, an increase in quantity of 30,210 long tons, or 14.76 per cent, and in value of $274,458, or 36.60 per cent. The greater part of the output was derived from Virginia, Colorado, Massachusetts, and New York, in the order of production.

Salt.—The salt product includes brine salt used in the manufacture of soda ash, caustic soda, etc.; at chemical works in Michigan, New York, and Pennsylvania. The production of salt in the United States during 1901 was 20,566,661 barrels of 280 pounds net, a decrease of 302,681 barrels, or 1.45 per cent, from the production in 1900 of 20,869,342 barrels. The value of the salt produced in 1901 was $6,617,449, a decrease of $327,154, or 4.71 per cent, from the 1900 value of $6,944,603. The production of salt in the United States during 1900 and 1901 was the greatest for any two individual years yet recorded.

Sulphur.—The quantity of sulphur produced in the United States has always been insignificant as compared with the total consumption of the country. During 1901 the production of sulphur in the United States was 7,690 short tons, valued at $223,430, as compared with 3,525 short tons, valued at $88,100, in 1900, an increase during 1901 of 4,165 tons in quantity, or about 118 per cent, and of $135,330 in value, or nearly 154 per cent. It is worthy of note that during 1901 Nevada and Oregon reentered the list of producing States, along with Utah and Louisiana.

PIGMENTS.

Barytes.—The output of crude barytes in 1901 was 49,070 short tons, valued at $157,844, a decrease of 18,610 tons from the production of 1900, which was 67,680 tons, valued at $188,089. In 1901, however, the average price per ton was $3.22, as compared with $2.78 in 1900, an increase accounted for by the fact that a better grade of barytes was put on the market.

Cobalt oxide.—The production of cobalt oxide in 1901 was 13,360 pounds, valued at $24,048, as compared with 6,471 pounds, valued at $11,648, in 1900, an increase of over 100 per cent in both quantity and value. All the cobalt oxide product was obtained as a by-product in smelting lead ores at Mine Lamotte, Mo.

Mineral paint.—The production of mineral paints in 1901 amounted to 61,460 short tons, valued at $789,962, as compared with 72,222 short tons, valued at $881,363, in 1900.

Zinc white.—The production of zinc white showed a slight decline, from 48,840 short tons in 1900 to 46,500 short tons in 1901, a decrease of 2,340 tons, or 4.79 per cent. The value of the product, however, increased from $3,667,210 in 1900 to $3,720,000, a gain of $52,790, or 1.44 per cent.

MISCELLANEOUS.

Asbestos.—As in 1900, nearly the entire product continued to come from the Sall Mountain mines, in White County, Ga., with small additions from California and Massachusetts. The production in 1901 was 747 short tons, valued at $13,498, as compared with 1,054 short tons, valued at 16,310, in 1900. The production promises to be considerably greater in 1902.

Asphaltum.—Under this title are included all the numerous varieties of bitumens or hydrocarbons occurring in the United States and not discussed in the chapter on petroleum. The production in 1901 was greater than that of 1900, though less than that of preceding years as far back as 1895. The amount was 63,134 short tons, valued at $555,335, as compared with 54,389 short tons, valued at $415,958, in 1900, and with 75,085 short tons in 1899, valued at $553,904.

Bauxite.—The production of bauxite continued to decrease in 1901, when it amounted to 18,905 long tons, valued at $79,914, as compared with 23,184 tons, valued at $89,676, in 1900, and with 35,280 tons, valued at $125,598, in 1899.

Chromic iron ore.—Since 1896, when the output of 786 long tons, worth $6,667, was obtained, there has been very little production of chromite in the United States until 1901, when California produced 368 long tons, valued at $5,790.

Feldspar.—The production of feldspar in 1901 showed a decided increase in quantity, 34,741 short tons, as against 24,821 short tons in 1900; also an increase in value, $220,422 in 1901, as against $180,971 in 1900.

Fibrous talc.—This variety of talc or soapstone occurs in but one locality in the United States—Gouverneur, St. Lawrence County, N. Y. It is used principally as a makeweight in the manufacture of medium grades of paper. The production in 1901, 69,200 short tons, valued at $483,600, is the largest yet recorded, though the value is less than the product of 1900.

Flint.—The production of flint in 1901 amounted to 34,420 short tons, an increase of 1,925 tons over 1900, and was valued at $149,297, an increase of $62,946 over 1900.

Fuller's earth.—The production of fuller's earth in 1901 showed an increase over the production of 1900, being 14,112 short tons, valued at $96,835, as compared with 9,698 short tons, valued at $67,535, in 1900. The maximum production of fuller's earth was obtained in 1897, when the output was 17,113 short tons.

Graphite.—The production of crystalline graphite in the United States for 1901 was 3,967,612 pounds, valued at $135,914, as compared with 5,507,855 pounds, valued at $178,761, in 1900. The production of amorphous graphite in 1901 was 809 short tons, valued at $31,800. In addition to this production there was considerable activity in developing the graphite mines in Georgia, Montana, Dakota, and New Jersey, in the aggregate some 2,500 tons of material being mined.

The production of artificial graphite was 2,500,000 pounds, valued at $119,000, the average price being 4.75 cents, as compared with 860,750 pounds, valued at $68,860, the average price being 8 cents per pound in 1900.

Limestone for iron flux.—The amount of limestone used for fluxing in blast furnaces in 1901 was 8,540,168 long tons, valued at $4,659,836, as compared with 7,495,435 long tons, valued at $3,687,394 in 1900.

Lithium.—The production of lithium minerals in 1901, amounting to 1,750 tons, valued at $43,000, was more than three times the production of 1900, which was about 520 tons. The average price received for these lithium minerals in 1901 was $23.68 per ton. It is expected that there will be a further increase in the production of lithium in 1902.

Magnesite.—This product comes entirely from California. The production in 1901 was by far the largest yet obtained, rising from 2,252 short tons in 1900, the maximum at that date, to 13,172 tons in 1901, an increase of 10,920 tons, or 484.9 per cent. The value of the product increased from $19,333 in 1900 to $43,057 in 1901, a gain of $23,724, or 122.7 per cent.

Mica.—The total production of plate mica in 1901 was 360,060 pounds, valued at $98,859, as compared with 456,283 pounds in 1900, valued at $92,758, a decrease of 96,223 pounds, or 21.09 per cent, and a gain of $6,101, or 6.58 per cent. The production of scrap mica showed a still greater falling off, or from 5,497 tons in 1900 to 2,171 tons in 1901, a decrease of 3,326 tons, or 60.50 per cent, while the value decreased from $55,202 in 1900 to $19,719 in 1901, a loss of $35,483, or 64.28 per cent. The falling off in the production of scrap mica is probably due to the exhaustion of the large piles of scrap that had accumulated when there was a market only for plate mica.

Mineral waters.—The amount of commercial natural waters sold in 1901 was, as it was also in 1900, about 8,000,000 gallons more than in the preceding year, but unlike 1900 there was a very considerable gain in value in 1901. In 1901 55,771,188 gallons were sold, valued at

$7,586,962, as compared with 47,558,784 gallons, valued at $6,245,172 in 1900, a gain of $1,341,790 in 1901.

Monazite.—The production of monazite in 1901 amounted to 748,736 pounds, valued at $59,262, as compared with 908,000 pounds, valued at $48,805, for 1900, an increase of $10,457 in value and a decrease of 159,264 pounds in amount, both increase and decrease being probably caused by the improved condition in which the crude material was marketed.

Molybdenum.—The production of molybdenite in the United States in 1901 has probably not exceeded 10 to 15 tons. The quotations of prices vary widely from 10 to 15 cents a pound to $1.10 a pound. The production of 1902 will probably greatly exceed that of 1901.

Precious stones.—The value of the gems and precious stones found in the United States in 1901 was $289,050, as compared with $233,170 in 1900, and with $185,770 in 1899. The principal features connected with this industry in 1901 were the increased mining of the fine blue sapphires in Fergus County, Mont.; the extensive working of a deposit of rhodolite garnet in the Cowee valley, Macon County, N. C.; the active working of the tourmaline deposits at Mesa Grande, San Diego County, Cal., and the discovery of a new nearby deposit; the formation of several new turquoise companies for mining in New Mexico; the finding of one diamond in Lee County, Ga., and the finding of magnificent epidote crystals in Prince of Wales Island, Alaska.

Pumice stone.—No pumice was produced in 1901.

Rutile.—The production of rutile in 1901 rose from 300 pounds, valued at $1,300, in 1900 to 44,250 pounds, valued at $5,710, in 1901. This great increase in the production of cheap rutile was due to the development of the deposits in Nelson County, Va.

Soapstone.—Exclusive of the production of fibrous talc from Gouverneur, N. Y., the production of soapstone and talc amounted in 1901 to 28,643 short tons, valued at $424,888, as compared with 27,943 short tons, valued at $383,541, in 1900. The output for 1901 was the largest on record, exceeding that of 1900, the year of previous largest production, by 700 short tons in amount and $41,347 in value, as 1900 had exceeded 1899 by 3,178 short tons in amount and $52,736 in value.

Tungsten.—The production of tungsten ores in 1901 amounted to 179 short tons, concentrated from 1,221 short tons of crude ore, and was valued at $27,720, an average price of $154.86 per ton. The price of tungsten ores has decreased from 50 to 75 per cent during the last two years.

Uranium and vanadium.—The production, confined chiefly to Colorado, of the minerals containing uranium and vanadium in 1901 amounted to about 375 short tons. The value of this product is difficult to estimate, some of the crude ore selling for $150 per ton and some of the uranium oxide selling for $1.20 per pound.

Mineral products of the United

	Product.	1900.	
		Quantity.	Value.
	METALLIC.		
1	Pig iron, spot value ... long tons..	13,789,242	$259,944,000
2	Silver, coining value ... troy ounces..	57,647,000	74,533,495
3	Gold, coining value ... do....	3,829,897	79,171,000
4	Copper, value at New York City ... pounds..	606,117,166	98,494,039
5	Lead, value at New York City ... short tons..	270,824	23,561,688
6	Zinc, value at New York City ... do....	123,886	10,654,196
7	Quicksilver, value at San Francisco ... flasks..	28,317	1,302,586
8	Aluminum, value at Pittsburg ... pounds..	7,150,000	1,920,000
9	Antimony, value at San Francisco ... short tons..	4,226	837,896
10	Nickel, value at Philadelphia ... pounds..	9,715	3,886
11	Tin ... do....	None.	....
12	Platinum, value (crude) at San Francisco ... troy ounces..	400	2,500
13	Total value of metallic products ...	....	550,425,286
	NONMETALLIC (SPOT VALUES).		
14	Bituminous coal ... short tons..	212,314,912	220,913,513
15	Pennsylvania anthracite ... long tons..	51,221,353	85,757,851
16	Natural gas ...	....	23,698,674
17	Petroleum ... barrels..	63,620,529	75,989,313
18	Brick clay ...	....	12,000,000
19	Cement ... barrels..	17,231,150	13,283,581
20	Stone ...	....	44,321,345
21	Corundum and emery ... short tons..	4,305	102,715
22	Garnet for abrasive purposes ... do....	3,185	123,475
23	Grindstones ...	....	710,026
24	Infusorial earth and tripoli ... short tons..	3,615	24,207
25	Millstones ...	....	32,858
26	Oilstones, etc ...	....	174,087
27	Borax ... short tons..	[a]1,602 [b]24,235	170,036 848,215
28	Bromine ... pounds..	521,444	140,790
29	Fluorspar ... short tons..	18,450	94,500
30	Gypsum ... do....	594,462	1,627,203
31	Marls ... do....	60,000	30,000
32	Phosphate rock ... long tons..	1,491,216	5,359,248
33	Pyrite ... do....	204,615	749,991
34	Salt ... barrels..	20,869,342	6,914,603
35	Sulphur ... short tons..	3,525	88,100
36	Barytes (crude) ... do....	67,680	188,089
37	Cobalt oxide ... pounds..	6,471	11,648
38	Mineral paints ... short tons..	72,222	881,363
39	Zinc white ... do....	48,840	3,667,210
40	Asbestos ... do....	1,054	16,310
41	Asphaltum ... do....	54,389	415,958
42	Bauxite ... long tons..	23,184	89,676
43	Chromic iron ore ... do....	140	1,400
44	Clay (all other than brick) ... do....	....	1,840,377
45	Feldspar ... short tons..	24,821	180,971
46	Fibrous talc ... do....	63,500	499,500
47	Flint ... do....	32,495	86,351
48	Fuller's earth ... do....	9,698	67,535
49	Graphite ...	[c]5,507,855 [d]611	197,579
50	Limestone for iron flux ... long tons..	7,495,435	3,687,394
51	Magnesite ... short tons..	2,252	19,333
52	Manganese ore ... long tons..	11,771	100,289
53	Mica (sheets) ... pounds..	456,283	92,758
54	Mica (scrap) ... short tons..	5,497	55,202
55	Mineral waters ... gallons sold..	47,558,784	6,245,172
56	Monazite ... pounds..	908,000	48,805
57	Ozocerite, refined ... do....	None.	None.
58	Precious stones ...	....	233,170
59	Pumice stone ... short tons..	None.	None.
60	Rutile ... pounds..	300	1,300
61	Soapstone ... short tons..	27,943	383,541
62	Total value of nonmetallic mineral products ...	....	512,195,262
63	Total value of metallic products ...	....	550,425,286
64	Estimated value of mineral products unspecified ...	....	1,000,000
65	Grand total ...	....	1,063,620,548

[a] Refined.
[b] Crude.
[c] Crystalline; pounds.
[d] Amorphous; short tons.

States in 1900 and 1901.

1901.		Increase (+) or decrease (—) in 1901.		Per cent of increase (+) or decrease (—).		
Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	
15,878,354	$242,174,000	+ 2,089,112	—$17,770,000	+ 15.15	— 6.84	1
55,214,000	71,387,800	— 2,433,000	— 3,145,695	— 4.22	— 4.22	2
3,805,500	78,666,700	— 24,397	— 504,300	— 0.64	— 0.64	3
602,072,519	87,300,515	— 4,044,647	— 11,193,524	— 0.67	— 11.36	4
270,700	23,280,200	— 124	— 281,488	— 0.05	— 1.19	5
140,822	11,265,760	+ 16,936	+ 611,564	+ 13.67	+ 5.74	6
29,727	1,382,305	+ 1,410	+ 79,719	+ 4.98	+ 6.12	7
7,150,000	2,238,000	....	+ 318,000	....	+ 16.56	8
2,649	542,020	— 1,577	— 295,876	— 37.32	— 35.31	9
6,700	3,551	— 3,015	— 335	— 31.03	— 8.62	10
None.	....	....	....	....	....	11
1,408	27,526	+ 1,008	+ 25,026	+252.00	+1,001.00	12
....	518,268,377	....	— 32,156,909	....	— 5.81	13
225,826,849	236,406,449	+13,511,937	+ 15,492,936	+ 6.36	+ 7.01	14
60,242,560	112,504,020	+ 9,021,207	+ 26,746,169	+ 17.61	+ 31.19	15
....	27,067,500	....	+ 3,368,826	....	+ 14.22	16
69,389,194	66,417,335	+ 5,768,665	— 9,571,978	+ 9.06	— 12.60	17
....	13,800,000	....	+ 1,800,000	....	+ 15.00	18
20,068,737	15,786,789	+ 2,837,587	+ 2,503,208	+ 16.47	+ 18.84	19
....	55,615,926	....	+ 11,294,581	....	+ 25.48	20
4,305	146,040	....	+ 43,325	....	+ 42.18	21
4,444	158,100	+ 1,259	+ 34,625	+ 39.53	+ 28.04	22
....	580,703	....	— 129,323	....	— 18.21	23
4,020	52,950	+ 405	+ 28,743	+ 11.20	+ 118.74	24
....	57,179	....	+ 24,321	....	+ 74.02	25
....	158,300	....	— 15,787	....	— 9.07	26
[a] 5,344 [b] 17,887	697,307 314,811	+ 3,742 — 6,348	+ 527,271 — 533.404	+233.58 — 26.19	+ 310.09 — 62.89	27
552,043	154,572	+ 30,599	+ 13,782	+ 5.87	+ 9.79	28
19,586	113,803	+ 1,136	+ 19,303	+ 6.16	+ 20.43	29
659,659	1,577,493	+ 65,197	— 49,710	+ 10.97	— 3.05	30
99,880	124,880	+ 39,880	+ 94,880	+ 66.47	+ 316.27	31
1,483,723	5,316,403	— 7,493	— 42,845	— 0.50	— 0.80	32
234,825	1,024,449	+ 30,210	+ 274,458	+ 14.76	+ 36.59	33
20,566,661	6,617,449	— 302,681	— 327,154	— 1.45	— 4.71	34
7,690	223,430	+ 4,165	+ 135,330	+118.16	+ 153.61	35
49,070	157,844	— 18,610	— 30,245	— 27.50	— 16.08	36
13,360	24,048	+ 6,889	+ 12,400	+106.46	+ 106.46	37
61,460	789,962	— 10,762	— 91,401	— 14.90	— 10.37	38
46,500	3,720,000	— 2,340	+ 52,790	— 4.79	+ 1.44	39
747	13,498	— 307	— 2,812	— 29.12	— 17.24	40
63,134	555,335	+ 8,745	+ 139,377	+ 16.08	+ 33.51	41
18,905	79,914	— 4,279	— 9,762	— 18.46	— 10.89	42
368	5,790	+ 228	+ 4,390	+162.86	+ 313.57	43
....	2,576,932	....	+ 736,555	....	+ 40.02	44
34,741	220,422	+ 9,920	+ 39,451	+ 39.97	+ 21.80	45
69,200	483,600	+ 5,700	— 15,900	+ 8.98	— 3.18	46
34,420	149,297	+ 1,925	+ 62,946	+ 5.92	+ 72.90	47
14,112	96,835	+ 4,414	+ 29,300	+ 45.51	+ 43.38	48
[c] 3,967,612 [d] 809	167,714	— 1,540,243 + 198	— 29,865	— 27.96 + 32.41	— 15.12	49
8,540,168	4,659,836	+ 1,044,733	+ 972,442	+ 13.94	+ 26.37	50
13,172	43,057	+ 10,920	+ 23,724	+484.90	+ 122.71	51
11,995	116,722	+ 224	+ 16,433	+ 1.90	+ 16.39	52
360,060	98,859	— 96,223	+ 6,101	— 21.09	+ 6.58	53
2,171	19,719	— 3,326	— 35,483	— 60.50	— 64.28	54
55,771,188	7,586,962	+ 8,212,404	+ 1,341,790	+ 17.27	+ 21.49	55
748,736	59,262	— 159,264	+ 10,457	— 17.54	+ 21.43	56
None.	None.	....	....	....	....	57
....	289,050	....	+ 55,880	....	+ 23.97	58
None.	None.	....	....	....	....	59
44,250	5,710	....	+ 4,410	....	+ 339.23	60
28,643	424,888	+ 700	+ 41,347	+ 2.51	+ 10.78	61
....	567,261,144	....	+ 55,065,882	....	+ 10.75	62
....	518,268,377	....	— 32,156,909	....	— 5.84	63
....	1,000,000	....	1,000,000	....	....	64
....	1,086,529,521	....	+ 22,908,973	....	+ 2.15	65

[a] Refined.
[b] Crude.
[c] Crystalline; pounds.
[d] Amorphous; short tons.

Mineral products of the United States

	Product.	1880.	
		Quantity.	Value.
	METALLIC.		
1	Pig iron, value at Philadelphia ....long tons..	3, 375, 912	$89, 315, 569
2	Silver, coining value..................troy ounces..	30, 320, 000	39, 200, 000
3	Gold, coining value ....do....	1, 741, 500	36, 000, 000
4	Copper, value at New York City ....pounds..	60, 480, 000	11, 491, 200
5	Lead, value at New York City........short tons..	97, 825	9, 782, 500
6	Zinc, value at New York City ....do....	23, 239	2, 277, 432
7	Quicksilver, value at San Francisco ....flasks..	59, 926	1, 797, 780
8	Nickel, value at Philadelphia ....pounds..	329, 968	164, 984
9	Aluminum, value at Pittsburg...............do....	....	....
10	Antimony, value at San Francisco ....short tons..	50	10, 000
11	Platinum (crude), value at San Francisco, troy ounces.	100	400
12	Total value of metallic products	....	190, 039, 865
	NONMETALLIC (SPOT VALUES).		
13	Bituminous coal...........................long tons..	38, 242, 641	53, 443, 718
14	Pennsylvania anthracite ....do....	25, 580, 189	42, 196, 678
15	Stone...do....	....	18, 356, 055
16	Petroleum ....barrels..	26, 286, 123	24, 183, 233
17	Lime ....do....	28, 000, 000	19, 000, 000
18	Natural gas..	....	....
19	Cement...barrels..	2, 072, 943	1, 852, 707
20	Salt ....do....	5, 961, 060	4, 829, 566
21	Phosphate rock ....long tons..	211, 377	1, 123, 823
22	Limestone for iron flux ....do....	4, 500, 000	3, 800, 000
23	Mineral waters ....gallons sold..	2, 000, 000	500, 000
24	Zinc white..........................short tons..	10, 107	763, 738
25	Potters' clay ....long tons..	25, 783	200, 457
26	Mineral paints ....short tons..	3, 604	135, 840
27	Borax ....pounds..	3, 692, 443	277, 233
28	Gypsum ....short tons..	90, 000	400, 000
29	Grindstones	....	500, 000
30	Fibrous talc.........................short tons..	4, 210	54, 730
31	Pyrites ....long tons..	2, 000	5, 000
32	Soapstone..........................short tons..	8, 441	66, 665
33	Manganese ore.....................long tons..	5, 761	86, 415
34	Asphaltum ....short tons..	444	4, 440
35	Precious stones	....	100, 000
36	Bromine ....pounds..	404, 690	114, 752
37	Corundum...........................short tons..	1, 044	29, 280
38	Barytes (crude) ....do....	20, 000	80, 000
39	Graphite ....pounds..	....	49, 800
40	Millstones..	....	200, 000
41	Oilstones, etc. *a*............................pounds..	420, 000	8, 000
42	Marls.................................short tons..	1, 000, 000	500, 000
43	Flint ....long tons..	20, 000	80, 000
44	Fluorspar...........................short tons..	4, 000	16, 000
45	Chromic iron ore..................long tons..	2, 288	27, 808
46	Infusorial earth ....short tons..	1, 833	45, 660
47	Feldspar ....long tons..	12, 500	60, 000
48	Mica ....pounds..	81, 669	127, 825
49	Cobalt oxide ....do....	7, 251	24, 000
50	Slate ground as a pigment.........short tons..	1, 000	10, 000
51	Sulphur ....do....	600	21, 000
52	Asbestos ....do....	150	4, 312
53	Rutile...pounds..	100	400
54	Lithographic stone ....short tons..	....	....
55	Total value of nonmetallic mineral products.	....	173, 279, 135
56	Total value of metallic products..................	....	190, 039, 865
57	Estimated value of mineral products unspecified.	....	6, 000, 000
58	Grand total	....	369, 319, 000

a Prior to 1889, quantity and value are for rough stone quarried; since 1890 they are for finished product.

for the calendar years 1880 to 1901.

1881.		1882.		1883.		
Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	
4, 144, 254	$87, 029, 334	4, 623, 323	$106, 336, 429	4, 595, 510	$91, 910, 200	1
33, 077, 000	43, 000, 000	36, 197, 695	46, 800, 000	35, 733, 622	46, 200, 000	2
1, 676, 300	34, 700, 000	1, 572, 186	32, 500, 000	1, 451, 249	30, 000, 000	3
71, 680, 000	12, 175, 600	91, 646, 232	16, 038, 091	117, 151, 795	18, 064, 807	4
117, 085	11, 240, 160	132, 890	12, 624, 550	143, 957	12, 322, 719	5
26, 800	2, 680, 000	33, 765	3, 646, 620	36, 872	3, 311, 106	6
60, 851	1, 764, 679	52, 732	1, 487, 042	46, 725	1, 253, 632	7
265, 668	292, 235	281, 616	309, 777	58, 800	52, 920	8
....	....	....	....	83	875	9
50	10, 000	60	12, 000	60	12, 000	10
100	400	200	600	200	600	11
....	192, 892, 408	....	219, 755, 109	....	203, 128, 859	12
48, 179, 475	60, 224, 344	60, 861, 190	76, 076, 487	68, 531, 500	82, 237, 800	13
28, 500, 016	64, 125, 036	31, 358, 264	70, 556, 094	34, 336, 469	77, 257, 055	14
....	20, 000, 000	....	21, 000, 000	....	20, 000, 000	15
27, 661, 238	25, 448, 339	30, 510, 830	24, 065, 988	23, 449, 633	25, 790, 252	16
30, 000, 000	20, 000, 000	31, 000, 000	21, 700, 000	32, 000, 000	19, 200, 000	17
....	....	....	215, 000	....	475, 000	18
2, 500, 000	2, 000, 000	3, 250, 000	3, 672, 750	4, 190, 000	4, 293, 500	19
6, 200, 000	4, 200, 000	6, 412, 373	4, 320, 140	6, 192, 231	4, 211, 042	20
266, 734	1, 980, 259	332, 077	1, 992, 462	378, 380	2, 270, 280	21
6, 000, 000	4, 100, 000	3, 850, 000	2, 310, 000	3, 814, 273	1, 907, 136	22
3, 700, 000	700, 000	5, 000, 000	800, 000	7, 529, 423	1, 119, 603	23
10, 000	700, 000	10, 000	700, 000	12, 000	840, 000	24
25, 000	200, 000	30, 000	240, 000	32, 000	250, 000	25
6, 000	100, 000	7, 000	105, 000	7, 000	84, 000	26
4, 046, 000	304, 461	4, 236, 291	338, 903	6, 500, 000	585, 000	27
85, 000	350, 000	100, 000	450, 000	90, 000	420, 000	28
....	500, 000	....	700, 000	....	600, 000	29
5, 000	60, 000	6, 000	75, 000	6, 000	75, 000	30
10, 000	60, 000	12, 000	72, 000	25, 000	137, 500	31
7, 000	75, 000	6, 000	90, 000	8, 000	150, 000	32
4, 895	73, 425	4, 532	67, 980	6, 155	92, 325	33
2, 000	8, 000	3, 000	10, 500	3, 000	10, 500	34
....	110, 000	....	150, 000	....	207, 050	35
300, 000	75, 000	250, 000	75, 000	301, 100	72, 264	36
500	80, 000	500	80, 000	550	100, 000	37
20, 000	80, 000	20, 000	80, 000	27, 000	108, 000	38
400, 000	30, 000	425, 000	34, 000	575, 000	46, 000	39
....	150, 000	....	200, 000	....	150, 000	40
500, 000	8, 580	600, 000	10, 000	600, 000	10, 000	41
1, 000, 000	500, 000	1, 080, 000	540, 000	972, 000	486, 000	42
25, 000	100, 000	25, 000	100, 000	25, 000	100, 000	43
4, 000	16, 000	4, 000	20, 000	4, 000	20, 000	44
2, 000	30, 000	2, 500	50, 000	3, 000	60, 000	45
1, 000	10, 000	1, 000	8, 000	1, 000	5, 000	46
14, 000	70, 000	14, 000	70, 000	14, 100	71, 112	47
100, 000	250, 000	100, 000	250, 000	114, 000	285, 000	48
8, 280	25, 000	11, 653	32, 046	1, 096	2, 795	49
1, 000	10, 000	2, 000	24, 000	2, 000	24, 000	50
600	21, 000	600	21, 000	1, 000	27, 000	51
200	7, 000	1, 200	36, 000	1, 000	30, 000	52
200	700	500	1, 800	550	2, 000	53
50	1, 000	....	....	....	....	54
....	206, 783, 144	....	231, 340, 150	....	243, 812, 214	55
....	192, 892, 408	....	219, 755, 109	....	203, 128, 859	56
....	6, 500, 000	....	6, 500, 000	....	6, 500, 000	57
....	406, 175, 552	....	457, 595, 259	....	453, 441, 073	58

Mineral products of the United States for

	Product.	1884.	
		Quantity.	Value.
	METALLIC.		
1	Pig iron, value at Philadelphia ....long tons..	4,097,868	$73,761,624
2	Silver, coining value................troy ounces..	37,744,605	48,800,000
3	Gold, coining value.....................do....	1,489,949	30,800,000
4	Copper, value at New York City ....pounds..	145,221,934	17,789,687
5	Lead, value at New York City........short tons..	139,897	10,537,042
6	Zinc, value at New York City ....do....	38,544	3,422,707
7	Quicksilver, value at San Francisco ......flasks..	31,913	936,327
8	Nickel, value at Philadelphia ....pounds..	64,550	48,412
9	Aluminum, value at Pittsburg ....do....	150	1,350
10	Antimony, value at San Francisco ....short tons..	60	12,000
11	Platinum (crude), value at San Francisco, troy ounces.	150	450
12	Total value of metallic products	....	186,109,599
	NONMETALLIC (spot values).		
13	Bituminous coal ....long tons..	73,730,539	77,417,066
14	Pennsylvania anthracite ....do....	33,175,756	66,351,512
15	Stone.......................................do....	....	19,000,000
16	Petroleum ....barrels..	24,218,438	20,595,966
17	Lime ....do....	37,000,000	18,500,000
18	Natural gas	....	1,460,000
19	Brick clay	....	....
20	Clay (all other than brick) ....long tons..	35,000	270,000
21	Cement...........................barrels..	4,000,000	3,720,000
22	Salt ....do....	6,514,937	4,197,734
23	Phosphate rock ....long tons..	431,779	2,374,784
24	Limestone for iron flux ....do....	3,401,930	1,700,965
25	Mineral waters ....gallons sold..	10,215,328	1,459,143
26	Zinc white ....short tons..	13,000	910,000
27	Mineral paints ....do....	7,000	84,000
28	Borax ....pounds..	7,000,000	490,000
29	Gypsum ....short tons..	90,000	390,000
30	Grindstones	....	570,000
31	Fibrous talc......................short tons..	10,000	110,000
32	Pyrites ....long tons..	35,000	175,000
33	Soapstone........................short tons..	10,000	200,000
34	Manganese ore ....long tons..	10,180	122,160
35	Asphaltum ....short tons..	3,000	10,500
36	Precious stones	....	222,975
37	Bromine ....pounds..	281,100	67,464
38	Corundum ....short tons..	600	108,000
39	Barytes (crude) ....do....	25,000	100,000
40	Graphite ....pounds..	....	....
41	Millstones....................................	....	150,000
42	Oilstones, etc.*a* ....pounds..	800,000	12,000
43	Marls...........................short tons..	875,000	437,500
44	Flint ....long tons..	30,000	120,000
45	Fluorspar ....short tons..	4,000	20,000
46	Chromic iron ore...................long tons..	2,000	35,000
47	Infusorial earth ....short tons..	1,000	5,000
48	Feldspar...........................long tons..	10,900	55,112
49	Mica ....pounds..	147,410	368,525
50	Cobalt oxide ....do....	2,000	5,100
51	Slate ground as a pigment...........short tons..	2,000	20,000
52	Sulphur ....do....	500	12,000
53	Asbestos ....do....	1,000	30,000
54	Rutile...............................pounds..	600	2,000
55	Lithographic stone ....short tons..	....	....
56	Total value of nonmetallic mineral products..	....	221,879,506
57	Total value of metallic products..................	....	186,109,599
58	Estimated value of mineral products unspecified ..	....	5,000,000
59	Grand total	....	412,989,105

a Prior to 1889, quantity and value are for rough stone quarried; since 1890 they are for finished product.

the calendar years 1880 to 1901.—Continued.

1885.		1886.		1887.		
Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	
4,044,425	$64,712,400	5,683,329	$95,195,760	6,417,148	$121,925,800	1
39,910,279	51,600,000	39,445,312	51,000,000	41,269,240	53,350,000	2
1,538,376	31,800,000	1,881,250	35,000,000	1,596 500	33,000,000	3
170,962,607	18,292,999	161,235,381	16,527,651	185,227,331	21,115,916	4
129,412	10,469,431	130,629	12,200,749	145,700	13,113,000	5
40,688	3,539,856	42,641	3,752,408	50,340	4,782,300	6
32,073	979,189	29,981	1,060,000	33,825	1,429,000	7
277,904	179,975	214,992	127,157	205,566	133,200	8
283	2,550	3,000	27,000	18,000	59,000	9
50	10,000	35	7,000	75	15,000	10
250	187	50	100	448	1,838	11
....	181,586,587	....	214,897,825	....	248,925,054	12
64,840,668	82,347,648	73,707,957	78,481,056	87,887,360	98,004,656	13
34,228,548	76,671,948	34,853,077	76,119,120	37,578,747	84,552,181	14
....	19,000,000	....	19,000,000	....	25,000,000	15
21,847,205	19,198,243	28,064,841	19,996,313	28,278,866	18,877,094	16
40,000,000	20,000,000	....	....	....	....	17
....	4,857,200	....	10,012,000	....	15,817,500	18
....	....	....	6,200,000	....	7,000,000	19
36,000	275,000	40,000	325,000	43,000	340,000	20
4,150,000	3,492,500	4,500,000	3,990,000	6,692,744	5,674,377	21
7,038,653	4,825,345	7,707,081	4,736,585	7,831,962	4,093,846	22
437,856	2,846,064	430,549	1,872,936	480,558	1,836,818	23
3,356,956	1,678,478	4,717,163	2,830,297	5,377,000	3,226,200	24
9,148,401	1,312,845	8,950,317	1,284,070	8,259,609	1,261,463	25
15,000	1,050,000	18,000	1,440,000	18,000	1,440,000	26
3,950	43,575	18,800	315,000	22,000	330,000	27
8,000,000	480,000	9,778,290	488,915	11,000,000	550,000	28
90,405	405,000	95,250	428,625	95,000	425,000	29
....	500,000	....	250,000	....	224,400	30
10,000	110,000	12,000	125,000	15,000	160,000	31
49,000	220,500	55,000	220,000	52,000	210,000	32
10,000	200,000	12,000	225,000	12,000	225,000	33
23,258	190,281	30,193	277,636	34,524	333,844	34
3,000	10,500	3,500	14,000	4,000	16,000	35
....	209,900	....	119,056	....	163,600	36
310,000	89,900	428,334	141,350	199,087	61,717	37
600	108,000	645	116,190	600	108,000	38
15,000	75,000	10,000	50,000	15,000	75,000	39
327,883	26,231	415,525	33,242	416,000	34,000	40
....	100,000	....	140,000	....	100,000	41
1,000,000	15,000	1,160,000	15,000	1,200,000	16,000	42
875,000	437,500	800,000	400,000	600,000	300,000	43
30,000	120,000	30,000	120,000	32,000	128,000	44
5,000	22,500	5,000	22,000	5,000	20,000	45
2,700	40,000	2,000	30,000	3,000	40,000	46
1,000	5,000	1,200	6,000	3,000	15,000	47
13,600	68,000	14,900	74,500	10,200	61,200	48
92,000	161,000	40,000	70,000	70,000	142,250	49
68,723	65,373	35,000	36,878	18,340	18,774	50
1,975	24,687	....	....	....	....	51
715	17,875	2,500	75,000	3,000	100,000	52
300	9,000	200	6,000	150	4,500	53
600	2,000	600	2,000	1,000	3,000	54
....	....	....	....	....	....	55
....	241,312,093	....	230,088,769	....	270,989,420	56
....	181,586,587	....	214,897,825	....	248,925,054	57
....	5,000,000	....	800,000	....	800,000	58
....	427,898,680	....	445,786,594	....	520,714,474	59

Mineral products of the United States for

	Product.	1888.	
		Quantity.	Value.
	METALLIC.		
1	Pig iron, value at Philadelphia...long tons	6, 489, 738	$107, 000, 000
2	Silver, coining value...troy ounces	45, 783, 632	59, 195, 000
3	Gold, coining value...do	1, 604, 927	33, 175, 000
4	Copper, value at New York City...pounds	231, 270, 622	33, 833, 954
5	Lead, value at New York City...short tons	151, 919	13, 399, 256
6	Zinc, value at New York City...do	55, 903	5, 500, 855
7	Quicksilver, value at San Francisco...flasks	33, 250	1, 413, 125
8	Aluminum, value at Pittsburg...pounds	19, 000	65, 000
9	Antimony, value at San Francisco...short tons	100	20, 000
10	Nickel, value at Philadelphia...pounds	204, 328	127, 632
11	Tin...do		
12	Platinum (crude), value at San Francisco, troy ounces.	500	2, 000
13	Total value of metallic products		253, 731, 822
	NONMETALLIC (spot values).		
14	Bituminous coal...short tons	102, 039, 838	101, 860, 529
15	Pennsylvania anthracite...long tons	41, 624, 611	89, 020, 483
16	Stone		25, 500, 000
17	Petroleum...barrels	27, 612, 025	17, 947, 620
18	Natural gas		22, 629, 875
19	Brick clay		7, 500, 000
20	Clay (all other than brick)...long tons	36, 750	300, 000
21	Cement...barrels	6, 503, 295	5, 021, 139
22	Mineral waters...gallons sold	9, 578, 648	1, 679, 302
23	Phosphate rock...long tons	448, 567	2, 018, 552
24	Salt...barrels	8, 055, 881	4, 374, 203
25	Limestone for iron flux...long tons	5, 438, 000	2, 719, 000
26	Zinc white...short tons	20, 000	1, 600, 000
27	Gypsum...do	110, 000	550, 000
28	Borax...pounds	7, 589, 000	455, 340
29	Mineral paints...short tons	26, 500	405, 000
30	Grindstones		281, 800
31	Fibrous talc...short tons	20, 000	210, 000
32	Asphaltum...do	53, 800	331, 500
33	Soapstone...do	15, 000	250, 000
34	Precious stones		139, 850
35	Pyrites...long tons	54, 331	167, 658
36	Corundum...short tons	589	91, 620
37	Oilstones, etc. *a*...pounds	1, 500, 000	18, 000
38	Mica...do	48, 000	70, 000
39	Barytes (crude)...short tons	20, 000	110, 000
40	Bromine...pounds	307, 386	95, 290
41	Fluorspar...short tons	6, 000	30, 000
42	Feldspar...long tons	8, 700	50, 000
43	Manganese ore...do	29, 198	279, 571
44	Flint...do	30, 000	127, 500
45	Graphite...pounds	400, 000	33, 000
46	Bauxite...long tons		
47	Sulphur...short tons		
48	Marls...do	300, 000	150, 000
49	Infusorial earth...do	1, 500	7, 500
50	Millstones		81, 000
51	Chromic iron ore...long tons	1, 500	20, 000
52	Cobalt oxide...pounds	8, 491	15, 782
53	Magnesite...short tons		
54	Asbestos...do	100	3, 000
55	Rutile...pounds	1, 000	3, 000
56	Ozocerite (refined)...do	43, 500	3, 000
57	Total value of nonmetallic mineral products.		286, 150, 114
58	Total value of metallic products		253, 731, 822
59	Estimated value of mineral products unspecified		900, 000
60	Grand total		540, 781, 936

a Prior to 1889, quantity and value are for rough stone quarried; since 1890 they are for finished product.

the calendar years 1880 to 1901—Continued.

1889.		1890.		1891.		
Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	
7,603,642	$120,000,000	9,202,703	$151,200,410	8,279,870	$128,337,985	1
51,354,851	66,396,988	54,500,000	70,464,645	58,330,000	75,416,565	2
1,590,869	32,886,744	1,588,880	32,845,000	1,604,840	33,175,000	3
231,246,214	26,907,809	265,115,133	30,848,797	295,812,076	38,455,300	4
156,397	13,794,235	143,630	12,668,166	178,554	15,534,198	5
58,860	5,791,824	63,683	6,266,407	80,873	8,033,700	6
26,484	1,190,500	22,926	1,203,615	22,904	1,036,386	7
47,468	97,335	61,281	61,281	150,000	100,000	8
115	28,000	938	177,508	1,289	217,957	9
252,663	151,598	223,488	134,093	118,498	71,099	10
....	....	....	....	125,289	25,058	11
500	2,000	600	2,500	100	500	12
....	267,247,033	....	305,872,422	....	300,403,748	13
95,685,543	94,504,745	111,320,016	110,420,801	117,901,237	117,188,400	14
40,714,721	65,879,514	41,489,858	66,383,772	45,236,992	73,944,735	15
....	42,809,706	....	47,000,000	....	47,294,746	16
35,163,513	26,963,340	45,822,672	35,365,105	54,291,980	30,526,553	17
....	21,097,099	....	18,742,725	....	15,500,084	18
....	8,000,000	....	8,500,000	....	9,000,000	19
294,344	635,578	350,000	756,000	400,000	900,000	20
7,000,000	5,000,000	8,000,000	6,000,000	8,222,792	6,680,951	21
12,780,471	1,748,458	13,907,418	2,600,750	18,392,732	2,996,259	22
550,245	2,937,776	510,499	3,213,795	587,988	3,651,150	23
8,005,565	4,195,412	8,776,991	4,752,286	9,987,945	4,716,121	24
6,318,000	3,159,000	5,521,622	2,760,811	5,000,000	2,300,000	25
16,970	1,357,600	....	1,600,000	23,700	1,600,000	26
267,769	764,118	182,995	574,523	208,126	628,051	27
8,000,000	500,000	9,500,000	617,500	13,380,000	869,700	28
34,307	483,766	47,732	681,992	49,652	678,478	29
....	439,587	....	450,000	....	476,113	30
23,746	244,170	41,354	389,196	53,054	493,068	31
51,735	171,537	40,841	190,416	45,054	242,264	32
12,715	231,708	13,670	252,309	16,514	243,981	33
....	188,807	....	118,833	....	235,300	34
93,705	202,119	99,854	273,745	106,536	338,880	35
2,245	105,565	1,970	89,395	2,265	90,230	36
5,982,000	32,980	....	69,909	1,375,000	150,000	37
49,500	50,000	60,000	75,000	75,000	100,000	38
19,161	106,313	21,911	86,505	31,069	118,363	39
418,891	125,667	387,847	104,719	343,000	54,880	40
9,500	45,835	8,250	55,328	10,044	78,330	41
6,970	39,370	8,000	45,200	10,000	50,000	42
24,197	240,559	25,684	219,050	23,416	239,129	43
21,113	89,730	13,000	57,400	15,000	60,000	44
....	72,662	....	77,500	....	110,000	45
728	2,366	1,844	6,012	3,593	11,675	46
1,150	7,850	....	....	1,200	39,600	47
139,522	63,956	153,620	69,880	135,000	67,500	48
3,466	23,372	2,532	50,240	....	21,988	49
....	35,155	....	23,720	....	16,587	50
2,000	30,000	3,599	53,985	1,372	20,580	51
13,955	31,092	6,788	16,291	7,200	18,000	52
....	....	....	....	439	4,390	53
30	1,800	71	4,560	66	3,960	54
1,000	3,000	400	1,000	300	800	55
50,000	2,500	350,000	26,250	50,000	7,000	56
....	282,623,812	....	312,776,503	....	321,767,846	57
....	267,247,033	....	305,872,422	....	300,403,748	58
....	1,000,000	....	1,000,000	....	1,000,000	59
....	550,870,845	....	619,648,925	....	623,171,594	60

Mineral products of the United States for

	Product.		1892.	
			Quantity.	Value.
	METALLIC.			
1	Pig iron, spot value	long tons	9,157,000	$131,161,039
2	Silver, coining value	troy ounces	63,500,000	82,099,150
3	Gold, coining value	do	1,596,375	33,000,000
4	Copper, value at New York City	pounds	352,971,744	37,977,142
5	Lead, value at New York City	short tons	173,654	13,892,320
6	Zinc, value at New York City	do	87,260	8,027,920
7	Quicksilver, value at San Francisco	flasks	27,993	1,245,689
8	Aluminum, value at Pittsburg	pounds	259,885	172,824
9	Antimony, value at San Francisco	short tons	1,790	276,416
10	Nickel, value at Philadelphia	pounds	92,252	50,739
11	Tin	do	162,000	32,400
12	Platinum, value (crude) at San Francisco	troy ounces	80	550
13	Total value of metallic products			307,936,189
	NONMETALLIC (SPOT VALUES).			
14	Bituminous coal	short tons	126,856,567	125,124,381
15	Pennsylvania anthracite	long tons	46,850,450	82,442,000
16	Natural gas			14,800,714
17	Petroleum	barrels	50,509,136	26,034,196
18	Brick clay			9,000,000
19	Cement	barrels	8,758,621	7,152,750
20	Stone			48,706,625
21	Corundum and emery	short tons	1,771	181,300
22	Garnet for abrasive purposes	do		
23	Grindstones			272,244
24	Infusorial earth and tripoli	short tons		43,655
25	Millstones			23,417
26	Oilstones, etc			146,730
27	Borax	pounds	13,500,000	900,000
28	Bromine	do	379,480	64,502
29	Fluorspar	short tons	12,250	89,000
30	Gypsum	do	256,259	695,492
31	Marls	do	125,000	65,000
32	Phosphate rock	long tons	681,571	3,296,227
33	Pyrite	do	109,788	305,191
34	Salt	barrels	11,698,890	5,654,915
35	Sulphur	short tons	2,688	80,640
36	Barytes, crude	do	32,108	130,025
37	Cobalt oxide	pounds	7,869	15,738
38	Mineral paints	short tons	51,704	767,766
39	Zinc white	do	27,500	2,200,000
40	Asbestos	do	104	6,416
41	Asphaltum	do	87,680	445,375
42	Bauxite	long tons	10,518	34,183
43	Chromic iron ore	do	1,500	25,000
44	Clay, all other than brick	do	420,000	1,000,000
45	Feldspar	short tons	16,800	75,000
46	Fibrous talc	do	41,925	472,485
47	Flint	do	22,400	80,000
48	Fuller's earth	do		
49	Graphite	pounds		104,000
50	Limestone for iron flux	long tons	5,172,114	3,620,480
51	Magnesite	short tons	1,004	10,040
52	Manganese ore	long tons	13,613	129,586
53	Mica	pounds	75,000	100,000
54	Mineral waters	gallons sold	21,876,604	4,905,970
55	Monazite	pounds		
56	Ozocerite, refined	do	60,000	8,000
57	Precious stones			312,050
58	Pumice stone	short tons		
59	Rutile	pounds	100	300
60	Soapstone	short tons	23,908	437,449
61	Total value of nonmetallic mineral products			339,958,842
62	Total value of metallic products			307,936,189
63	Estimated value of mineral products unspecified			1,000,000
64	Grand total			648,895,031

the calendar years 1880 to 1901—Continued.

1893.		1894.		1895.		
Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	
7,124,502	$84,810,426	6,657,388	$65,007,247	9,446,308	$105,198,550	1
60,000,000	77,575,757	49,501,122	64,000,000	55,727,000	72,051,000	2
1,739,081	35,950,000	1,910,816	39,500,000	2,254,760	46,610,000	3
339,785,972	32,054,601	364,866,808	33,141,142	392,639,964	38,682,347	4
163,982	11,839,590	159,331	9,942,254	170,000	11,220,000	5
78,832	6,306,560	75,328	5,288,026	89,686	6,278,020	6
30,164	1,108,527	30,416	934,000	36,104	1,337,131	7
339,629	266,903	550,000	316,250	920,000	464,600	8
1,503	270,540	1,387	249,706	2,013	304,169	9
49,399	22,197	9,616	3,269	10,302	3,091	10
8,938	1,788	None.		None.		11
75	517	100	600	150	900	12
	250,207,406		218,382,494		282,149,808	13
128,385,231	122,751,618	118,820,405	107,653,501	135,118,193	115,749,771	14
48,185,306	85,687,078	46,358,144	78,488,063	51,785,122	82,019,272	15
	14,346,250		13,954,400		13,006,650	16
48,412,666	28,932,326	49,344,516	35,522,095	52,892,276	57,632,296	17
	9,000,000		9,000,000		9,000,000	18
8,002,467	6,262,841	8,362,245	5,030,081	8,731,401	5,482,254	19
	33,885,573		36,534,788		33,319,131	20
1,713	142,325	1,495	95,936	2,102	106,256	21
						22
	338,787		223,214		205,768	23
	22,582	2,584	11,718	4,954	20,514	24
	16,645		13,887		22,542	25
	135,173		136,873		155,881	26
8,699,000	652,425	14,680,130	974,445	11,918,000	595,900	27
348,399	104,520	379,444	102,450	517,421	134,343	28
12,400	84,000	7,500	47,500	4,000	24,000	29
253,615	696,615	239,312	761,719	265,503	807,447	30
75,000	40,000	75,000	40,000	60,000	30,000	31
941,368	4,136,070	996,949	3,479,547	1,038,551	3,606,094	32
75,777	256,552	105,940	363,134	99,549	322,845	33
11,816,772	4,054,668	12,967,417	4,739,285	13,669,649	4,423,084	34
1,200	42,000	500	20,000	1,800	42,000	35
28,970	88,506	23,335	86,983	21,529	68,321	36
8,422	10,346	6,763	10,145	14,458	20,675	37
37,724	530,384	41,926	498,093	50,695	621,552	38
24,059	1,804,420	19,987	1,399,090	20,710	1,449,700	39
50	2,500	325	4,463	795	13,525	40
47,779	372,232	60,570	353,400	68,163	348,281	41
9,079	29,507	11,066	35,818	17,069	44,000	42
1,450	21,750	3,680	53,231	1,740	16,795	43
400,000	900,000	360,000	800,000	360,000	800,000	44
20,578	68,307	19,264	167,000	8,523	30,000	45
35,861	403,436	39,906	435,060	39,240	370,895	46
33,231	63,792	42,560	319,200	13,747	21,038	47
				6,900	41,400	48
843,103	63,232	918,000	64,010		52,582	49
3,958,055	2,374,833	3,698,550	1,849,275	5,247,949	2,623,974	50
704	7,040	1,440	10,240	2,200	17,000	51
7,718	66,614	6,308	53,635	9,547	71,769	52
66,971	88,929		52,388		55,831	53
23,544,495	4,246,734	21,569,608	3,741,846	21,463,543	4,254,237	54
130,000	7,600	546,855	36,193	1,573,000	137,150	55
				None.	None.	56
	264,041		132,250		113,621	57
						58
		150	450	100	350	59
21,071	255,067	23,144	401,325	21,495	266,495	60
	323,257,318		307,696,731		338,145,239	61
	250,207,406		218,382,494		282,149,808	62
	1,000,000		1,000,000		1,000,000	63
	574,464,724		527,079,225		621,295,047	64

Mineral products of the United States for

	Product.	1896.	
		Quantity.	Value.
	METALLIC.		
1	Pig iron, spot value ... long tons	8,623,127	$90,250,000
2	Silver, coining value ... troy ounces	58,834,800	76,069,236
3	Gold, coining value ... do	2,568,132	53,088,000
4	Copper, value at New York City ... pounds	460,061,430	49,456,603
5	Lead, value at New York City ... short tons	188,000	10,528,000
6	Zinc, value at New York City ... do	81,499	6,519,920
7	Quicksilver, value at San Francisco ... flasks	30,765	1,075,449
8	Aluminum, value at Pittsburg ... pounds	1,300,000	520,000
9	Antimony, value at San Francisco ... short tons	2,478	347,539
10	Nickel, value at Philadelphia ... pounds	17,170	4,464
11	Tin ... do	None.	
12	Platinum, value (crude) at San Francisco ... troy ounces	163	944
13	Total value of metallic products		287,860,155
	NONMETALLIC (SPOT VALUES).		
14	Bituminous coal ... short tons	137,640,276	114,891,515
15	Pennsylvania anthracite ... long tons	48,523,287	81,748,651
16	Natural gas		13,002,512
17	Petroleum ... barrels	60,960,361	58,518,709
18	Brick clay		9,000,000
19	Cement ... barrels	9,513,473	6,473,213
20	Stone		30,142,661
21	Corundum and emery ... short tons	2,120	113,246
22	Garnet for abrasive purposes ... do		
23	Grindstones		326,826
24	Infusorial earth and tripoli ... short tons	3,846	26,792
25	Millstones		22,567
26	Oilstones, etc		127,098
27	Borax ... pounds	13,508,000	675,400
28	Bromine ... do	546,580	144,501
29	Fluorspar ... short tons	6,500	52,000
30	Gypsum ... do	224,139	573,344
31	Marls ... do	60,000	30,000
32	Phosphate rock ... long tons	930,779	2,803,372
33	Pyrite ... do	115,483	320,163
34	Salt ... barrels	13,850,726	4,040,839
35	Sulphur ... short tons	5,260	87,200
36	Barytes, crude ... do	17,068	46,513
37	Cobalt oxide ... pounds	10,700	15,301
38	Mineral paints ... short tons	48,032	530,455
39	Zinc white ... do	20,000	1,400,000
40	Asbestos ... do	504	6,100
41	Asphaltum ... do	80,503	577,563
42	Bauxite ... long tons	18,364	47,338
43	Chromic iron ore ... do	786	6,667
44	Clay, all other than brick ... do	360,000	800,000
45	Feldspar ... short tons	10,203	35,200
46	Fibrous talc ... do	46,089	399,443
47	Flint ... do	12,458	24,226
48	Fuller's earth ... do	9,872	59,360
49	Graphite, crystalline ... pounds	535,858	48,460
50	Graphite, amorphous ... short tons	760	
51	Limestone for iron flux ... long tons	4,120,102	2,060,000
52	Magnesite ... short tons	1,500	11,000
53	Manganese ore ... long tons	10,088	90,727
54	Mica, sheet ... pounds		65,441
55	Mica, scrap ... short tons		1,750
56	Mineral waters ... gallons sold	25,795,312	4,136,192
57	Monazite ... pounds	30,000	1,500
58	Ozocerite, refined ... do	None.	None.
59	Precious stones		97,850
60	Pumice stone ... short tons		
61	Rutile ... pounds	100	350
62	Soapstone ... short tons	22,183	354,065
63	Total value of nonmetallic mineral products		333,936,110
64	Total value of metallic products		287,860,155
65	Estimated value of mineral products unspecified		1,000,000
66	Grand total		622,796,265

the calendar years 1880 to 1901—Continued.

1897.		1898.		1899.		
Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	
9,652,680	$95,122,299	11,773,934	$116,557,000	13,620,703	$245,172,654	1
53,860,000	69,637,172	54,438,000	70,384,485	54,764,500	70,806,626	2
2,774,935	57,363,000	3,118,398	64,463,000	3,437,210	71,053,400	3
494,078,274	54,080,180	526,512,987	61,865,276	568,666,921	101,222,712	4
212,000	14,885,728	222,000	16,650,000	210,500	18,945,000	5
99,980	8,498,300	115,399	10,385,910	129,051	14,840,865	6
26,648	993,445	31,092	1,188,627	30,454	1,452,745	7
4,000,000	1,500,000	5,200,000	1,716,000	5,200,000	1,716,000	8
3,061	442,300	3,238	532,101	2,861	559,189	9
23,707	7,823	11,145	3,956	22,541	8,566	10
None.	....	None.	....	None.	....	11
150	900	225	1,913	300	1,800	12
....	302,531,147	....	343,748,268	....	525,779,557	13
147,609,985	119,567,224	166,592,023	132,586,313	193,321,987	167,935,304	14
46,974,714	79,301,954	47,663,076	75,414,537	53,944,647	88,142,130	15
....	13,826,422	....	15,296,813	....	20,074,873	16
60,475,516	40,874,072	55,364,233	44,193,359	57,070,850	64,603,904	17
....	8,000,000	....	9,000,000	....	11,250,000	18
10,989,463	8,178,283	12,111,208	9,859,501	15,520,445	12,889,142	19
....	34,667,772	....	36,607,264	....	44,090,670	20
2,165	106,574	4,064	275,064	4,900	150,600	21
2,554	80,853	2,967	86,850	2,765	98,325	22
....	368,058	....	489,769	....	675,586	23
3,833	22,835	2,733	16,691	4,334	37,032	24
....	25,932	....	25,934	....	28,115	25
....	149,970	....	180,738	....	208,283	26
16,000,000	1,080,000	16,000,000	1,120,000	40,714,000	1,139,882	27
487,149	129,094	486,979	126,614	433,004	108,251	28
5,062	37,159	7,675	63,050	15,900	96,650	29
288,982	755,864	291,638	755,280	486,235	1,287,080	30
60,000	30,000	60,000	30,000	60,000	30,000	31
1,039,345	2,673,202	1,308,885	3,453,460	1,515,702	5,084,076	32
143,201	391,541	193,364	593,801	174,734	543,249	33
15,973,202	4,920,020	17,612,634	6,212,554	19,708,614	6,867,467	34
2,275	45,590	1,200	32,960	4,830	107,500	35
26,042	58,295	31,306	108,339	41,894	139,528	36
19,520	31,232	6,247	9,371	10,230	18,512	37
60,913	795,793	58,850	694,856	63,111	728,389	38
25,000	1,750,000	33,000	2,310,000	40,146	3,211,680	39
580	6,450	605	10,300	681	11,740	40
75,945	664,632	76,337	675,649	75,085	553,904	41
20,590	57,652	25,149	75,437	35,280	125,598	42
None.	None.	None.	None.	None.	None.	43
....	1,000,000	....	1,384,766	....	1,645,328	44
12,516	43,100	13,440	32,395	24,202	211,545	45
57,009	396,936	54,356	411,430	54,655	438,150	46
13,466	26,227	21,425	42,670	29,852	180,345	47
17,113	112,272	14,860	106,500	12,381	79,644	48
1,254,402	54,277	2,360,000	75,200	2,900,732	167,106	49
1,108		890		2,324		50
4,247,688	2,124,000	5,275,819	2,638,000	6,707,435	4,695,205	51
1,143	13,671	1,263	19,075	1,280	18,480	52
11,108	95,505	15,957	129,185	9,935	82,278	53
82,676	80,774	129,520	103,534	108,570	70,587	54
740	14,452	3,999	27,564	1,505	50,878	55
23,255,911	4,599,106	28,853,464	8,051,833	39,562,136	6,948,030	56
44,000	1,980	250,776	13,542	350,000	20,000	57
None.	None.	None.	None.	None.	None.	58
....	130,675	....	160,920	....	185,770	59
158	....	600	13,200	400	10,000	60
100	350	140	700	230	1,030	61
21,923	365,629	22,231	287,112	21,765	330,805	62
....	327,655,427	....	353,802,130	....	445,372,651	63
....	302,531,147	....	343,748,268	....	525,779,557	64
....	1,000,000	....	1,000,000	....	1,000,000	65
....	631,186,574	....	698,550,398	....	972,152,208	66

Mineral products of the United States for the calendar years 1880–1901—Continued.

Product.	1900.	
	Quantity.	Value.
METALLIC.		
Pig iron, spot value ... long tons..	13,789,242	$259,944,000
Silver, coining value ... troy ounces..	57,647,000	74,533,495
Gold, coining value ... do..	3,829,897	79,171,000
Copper, value at New York City ... pounds..	606,117,166	98,494,039
Lead, value at New York City ... short tons..	270,824	23,561,688
Zinc, value at New York City ... do....	123,886	10,654,196
Quicksilver, value at San Francisco ... flasks..	28,317	1,302,586
Aluminum, value at Pittsburg ... pounds..	7,150,000	1,920,000
Antimony, value at San Francisco ... short tons..	4,226	837,896
Nickel, value at Philadelphia ... pounds..	9,715	3,886
Tin ... do....	None.	....
Platinum, value (crude) at San Francisco ... troy ounces..	400	2,500
Total value of metallic products ...	....	550,425,286
NONMETALLIC (SPOT VALUES).		
Bituminous coal ... short tons..	212,314,912	220,913,513
Pennsylvania anthracite ... long tons..	51,221,353	85,757,851
Natural gas ...	....	23,698,674
Petroleum ... barrels..	63,620,529	75,989,313
Brick clay ...	....	12,000,000
Cement ... barrels..	17,231,150	13,283,581
Stone ...	....	44,321,345
Corundum and emery ... short tons..	4,305	102,715
Garnet for abrasive purposes ... do....	3,185	123,475
Grindstones ...	....	710,026
Infusorial earth and tripoli ... short tons..	3,615	24,207
Millstones ...	....	32,858
Oilstones, etc ...	....	174,087
Borax ... short tons..	[a] 1,602 [b] 24,235	170,036 848,215
Bromine ... pounds..	521,444	140,790
Fluorspar ... short tons..	18,450	94,500
Gypsum ... do....	594,462	1,627,203
Marls ... do....	60,000	30,000
Phosphate rock ... long tons..	1,491,216	5,359,248
Pyrite ... do....	204,615	749,991
Salt ... barrels..	20,869,342	6,944,603
Sulphur ... short tons..	3,525	88,100
Barytes, crude ... do....	67,680	188,089
Cobalt oxide ... pounds..	6,471	11,648
Mineral paints ... short tons..	72,222	881,363
Zinc white ... do....	48,840	3,667,210
Asbestos ... do....	1,054	16,310
Asphaltum ... do....	54,389	415,958
Bauxite ... long tons..	23,184	89,676
Chromic iron ore ... do....	140	1,400
Clay, all other than brick ...	....	1,840,377
Feldspar ... short tons..	24,821	180,971
Fibrous talc ... do....	63,500	499,500
Flint ... do....	32,495	86,351
Fuller's earth ... do....	9,698	67,535
Graphite, crystalline ... pounds..	5,507,855	197,579
Graphite, amorphous ... short tons..	611	
Limestone for iron flux ... long tons..	7,495,435	3,687,394
Magnesite ... short tons..	2,252	19,333
Manganese ore ... long tons..	11,771	100,289
Mica, sheet ... pounds..	456,283	92,758
Mica, scrap ... short tons..	5,497	55,202
Mineral waters ... gallons sold..	47,558,784	6,245,172
Monazite ... pounds..	908,000	48,805
Ozocerite, refined ... do....	None.	None.
Precious stones ...	....	233,170
Pumice stone ... short tons..	None.	None.
Rutile ... pounds..	300	1,300
Soapstone ... short tons..	27,943	383,541
Total value of nonmetallic mineral products ...	....	512,195,262
Total value of metallic products ...	....	550,425,286
Estimated value of mineral products unspecified ...	....	1,000,000
Grand total ...	....	1,063,620,548

[a] Refined.

[b] Crude,

Mineral products of the United States for the calendar years 1880–1901—Continued.

Product.	1901.	
	Quantity.	Value.
METALLIC.		
Pig iron, spot value .... long tons	15,878,354	$242,174,000
Silver, coining value .... troy ounces	55,214,000	71,387,800
Gold, coining value .... do	3,805,500	78,666,700
Copper, value at New York City .... pounds	602,072,519	87,300,515
Lead, value at New York City .... short tons	270,700	23,280,200
Zinc, value at New York City .... do	140,822	11,265,760
Quicksilver, value at San Francisco .... flasks	29,727	1,382,305
Aluminum, value at Pittsburg .... pounds	7,150,000	2,238,000
Antimony, value at San Francisco .... short tons	2,649	542,020
Nickel, value at Philadelphia .... pounds	6,700	3,551
Tin .... do	None.	
Platinum, value, crude at San Francisco .... troy ounces	1,408	27,526
Total value of metallic products		518,268,377
NONMETALLIC (SPOT VALUES).		
Bituminous coal .... short tons	225,826,849	236,406,449
Pennsylvania anthracite .... long tons	60,242,560	112,504,020
Natural gas		27,067,500
Petroleum .... barrels	69,389,194	66,417,335
Brick clay		13,800,000
Cement .... barrels	20,068,737	15,786,789
Stone		55,615,926
Corundum and emery .... short tons	4,305	146,040
Garnet for abrasive purposes .... do	4,444	158,100
Grindstones		580,703
Infusorial earth and tripoli .... short tons	4,020	52,950
Millstones		57,179
Oilstones, etc.		158,300
Borax .... tons	[a] 5,344	697,307
	[b] 17,887	314,811
Bromine .... pounds	552,043	154,572
Fluorspar .... short tons	19,586	113,803
Gypsum .... do	659,659	1,577,493
Marls .... do	99,880	124,880
Phosphate rock .... long tons	1,483,723	5,316,403
Pyrite .... do	234,825	1,024,449
Salt .... barrels	20,566,661	6,617,449
Sulphur .... short tons	7,690	223,430
Barytes, crude .... do	49,070	157,844
Cobalt oxide .... pounds	13,360	24,048
Mineral paints .... short tons	61,460	789,962
Zinc white .... do	46,500	3,720,000
Asbestos .... do	747	13,498
Asphaltum .... do	63,134	555,335
Bauxite .... long tons	18,905	79,914
Chromic iron ore .... do	368	5,790
Clay, all other than brick .... do		2,576,932
Feldspar .... short tons	34,741	220,422
Fibrous talc .... do	69,200	483,600
Flint .... do	34,420	149,297
Fuller's earth .... do	14,112	96,835
Graphite, crystalline .... pounds	3,967,612	167,714
Graphite, amorphous .... short tons	809	
Limestone for iron flux .... long tons	8,540,168	4,659,836
Magnesite .... short tons	13,172	43,057
Manganese ore .... long tons	11,995	116,722
Mica (sheet) .... pounds	360,060	98,859
Mica (scrap) .... tons	2,171	19,719
Mineral waters .... gallons sold	55,771,188	7,586,962
Monazite .... pounds	748,736	59,262
Ozocerite, refined .... do	None.	None.
Precious stones		289,050
Pumice stone .... short tons	None.	None.
Rutile .... pounds	44,250	5,710
Soapstone .... short tons	28,643	424,888
Total value of nonmetallic mineral products		567,261,144
Total value of metallic products		518,268,377
Estimated value of mineral products unspecified		1,000,000
Grand total		1,086,529,521

[a] Refined. [b] Crude.

IRON ORES.

By John Birkinbine.

PRODUCTION.

During the year ending December 31, 1901, according to reports furnished by the operators throughout the country, the total production of iron ore in the United States amounted to 28,887,479 long tons. This exceeds the previous yearly maxima of 27,553,161 long tons in 1900, 24,683,173 tons in 1899, and 19,433,716 tons in 1898. The increase shown by the figures of 1901 over those of 1900 was 1,334,318 long tons, or 5 per cent; and the gain over the product of 1898 was 9,453,763 tons, or 49 per cent, a phenomenal growth. The largest amounts of iron ores officially reported to date from any other countries are 18,964,294 metric tons, or 18,664,772 long tons, mined in Germany and Luxemburg in 1900, and 18,031,957 long tons mined in Great Britain in 1882.

The record of the production of iron ore in the United States in each year from 1889 to 1901, inclusive, is as follows:

Production of iron ores in the United States from 1889 to 1901.

Year.	Amount.
	Long tons.
1889	14,518,041
1890	16,036,043
1891	14,591,178
1892	16,296,666
1893	11,587,629
1894	11,879,679
1895	15,957,614
1896	16,005,449
1897	17,518,046
1898	19,433,716
1899	24,683,173
1900	27,553,161
1901	28,887,479
Total	234,947,874
Average for 13 years for which data have been collected by the U. S. Geological Survey	18,072,913

Twenty-five States and one Territory mined iron ore in the year 1901, the number of producing States remaining the same as in 1900; but no iron ore was reported as mined from Utah, while South Carolina shipped a sample carload. It is not probable, for the present, at least, that any continuous shipments of iron ore will be made from the State last named.

As in the year 1900, Minnesota contributed the greater portion of the increase for 1901, and advanced to first place as a producer, Michigan, which has uninterruptedly occupied this position since the year 1881, now being second.

The report for 1900 was criticised by persons whose local interest evidently influenced their opinions, because Minnesota was not then given first place. The fact that in 1900 Minnesota shipped more iron ore than Michigan was recorded in the report; but the State of Michigan produced more iron ore in 1900, and it is with production that we have to deal.

During the last year increased demands have been made on the Lake Superior region, especially on the Mesabi range of Minnesota; and if the present market rates continue, the output from this region will probably be limited more by the facilities for transportation than by the ability of the mines to produce the iron ore desired.

New explorations for standard ores in the Lake Superior district are being actively carried on; and, in addition, some of the siliceous and lower grade ores, of which large quantities exist, are liberally exploited. Both the higher grade ores and also some which are siliceous but low in phosphorus have been shipped; and it is probable that in years to come these comparatively low-grade ores will become more marketable, unless new sources of ore supply are developed.

In the central West, valuable deposits of iron ore in Wyoming, Colorado, and New Mexico are being worked extensively to supply the Colorado furnaces.

On the Pacific coast the Irondale furnace in Washington has resumed operations, but its principal reliance has so far been on the magnetite deposits of Texada Island, in British Columbia.

PRODUCTION BY VARIETIES OF ORE.

As in former reports, the iron ore mined has been divided into four general commercial classes, as follows:

1. *Red hematite*, including all anhydrous hematites, known by various names, such as red hematite, specular, micaceous, fossil, slate iron ore, martite, blue hematite, etc.
2. *Brown hematite*, including the varieties of hydrated sesquioxide of iron, recognized as limonite, gothite, turgite, bog ores, pipe ores, etc.
3. *Magnetite*, those ores in which the iron occurs as magnetic oxide and including some martite, which is mined with the magnetite.
4. *Carbonate*, those ores which contain a considerable amount of carbonic acid, such as spathic ore, blackband, siderite, clay ironstone, etc.

In 1901 the red hematite mines contributed 24,006,025 long tons, or 83.10 per cent of the total for the United States, an increase of 1,297,751 tons, or 6 per cent, over the 1900 total of 22,708,274 long tons. Minnesota was the largest producer of this class of ore, followed by Michigan and Alabama.

The brown hematite ore mined, 3,016,715 long tons, was 10.44 per cent of the total output of the country, a decrease of 214,374 long tons, or 7 per cent, from the 1900 record of 3,231,089 long tons. Virginia and West Virginia combined lead as a brown hematite producer, followed by Alabama and Tennessee.

Of magnetic ores, 1,813,076 long tons, or 6.28 per cent of the United States total, were mined in the year 1901, an advance of 275,525 long tons, or 18 per cent, over the 1,537,551 tons in 1900. Pennsylvania was the principal contributor, followed by New Jersey and New York.

But a comparatively small amount—51,663 long tons—of carbonate ore was won in 1901, being 0.18 per cent of the total iron-ore output in that year. Practically all of this came from Ohio, although Maryland, New York, and Pennsylvania contributed small amounts.

The quantities of the different varieties of iron ore produced by the different States in 1901 were as follows, the States being arranged in their order as total producers. The combining, in some cases, of the figures for two or more States is for the purpose of respecting statistics of individual mines.

Production of iron ore in the United States in 1901, by varieties.

[Long tons.]

State or Territory.	Red hematite.	Brown hematite.	Magnetite.	Carbonate.	Total.
Minnesota	11,109,537				11,109,537
Michigan	9,386,707	33,370	233,990		9,654,067
Alabama	2,070,422	731,310			2,801,732
Pennsylvania	42,381	226,699	771,351	253	1,040,684
Virginia and West Virginia	13,156	910,214	2,024		925,394
Tennessee	314,949	474,545			789,491
Wisconsin	725,496	13,372			738,868
New York	66,389	23,362	329,467	1,000	420,218
Colorado	6,978	397,059			404,037
New Jersey			401,989		401,989
Montana, Nevada, New Mexico, Texas, and Wyoming	157,059	5,220	72,235		234,514
Georgia, North and South Carolina	60,102	153,477	2,020		215,599
Kentucky and Iowa	41,623	4,876			46,499
Ohio				44,185	44,185
Connecticut and Massachusetts		25,214			25,214
Maryland		14,993		6,225	21,218
Missouri	11,226	3,004			14,230
Total	24,006,025	3,016,715	1,813,076	51,663	28,887,479

In the thirteen years since 1889, when the United States Geological Survey first collected the statistics of the different classes of iron ore mined, the red hematites have contributed 180,551,009 long tons, or 76.85 per cent of the total; the brown hematite mines, 30,945,504 long tons, or 13.17 per cent; the magnetic deposits, 21,524,693 long tons, or 9.16 per cent, and the carbonate ores 1,926,668 long tons, or 0.82 per cent of the total.

The changes which have occurred in this interval are shown by the production of iron ore in the United States by classes, from 1889 to 1901, as follows:

Production of iron ores in the United States, by classes, from 1889 to 1901, inclusive.

[Maxima in italics.]

Year.	Red hematite.	Brown hematite.	Magnetite.	Carbonate.	Total.
	Long tons.	*Long tons.*	*Long tons.*	*Long tons*	*Long tons.*
1889	9,056,288	2,523,087	2,506,415	*432,251*	14,518,041
1890	10,527,650	2,559,938	*2,570,838*	377,617	16,036,043
1891	9,327,398	2,757,564	2,317,108	189,108	14,591,178
1892	11,646,619	2,485,101	1,971,965	192,981	16,296,666
1893	8,272,637	1,849,272	1,330,886	134,834	11,587,629
1894	9,347,434	1,472,748	972,219	87,278	11,879,679
1895	12,513,995	2,102,358	1,268,222	73,039	15,957,614
1896	12,576,288	2,126,212	1,211,526	91,423	16,005,449
1897	14,413,318	1,961,954	1,059,479	83,295	17,518,046
1898	16,150,684	1,989,681	1,237,978	55,373	19,433,716
1899	20,004,399	2,869,785	1,727,430	81,559	24,683,173
1900	22,708,274	*3,231,089*	1,537,551	76,247	27,553,161
1901	*24,006,025*	3,016,715	1,813,076	51,663	*28,887,479*
Total	180,551,009	30,945,504	21,524,693	1,926,668	234,947,874
Percentages of totals for 13 years	76.85	13.17	9.16	0.82	100.00
Percentages of total for 1901	83.10	10.44	6.28	0.18	100.00

In 1901 the red hematite mines contributed their maximum quota; the brown hematite mines reached their maximum in 1900, the magnetite operations in 1890, and the carbonate in 1889.

In addition to the iron ore produced, 52,311 tons of zinc residuum were used as iron ore in 1901.

In 1901 there were reported 108,887 long tons of concentrated magnetic ore, which is included in the above table. The methods of improving ores and of creating from those which are undesirable a satisfactory product have not developed as rapidly as might be expected, but with the large quantities of material available and with the improvements in crushing, sizing, and separating appliances, an increasing output may be anticipated.

LAKE SUPERIOR REGION.

The greater part of the iron ore of the United States continues to be supplied by the Lake Superior region, which produced its maximum output of 21,445,903 long tons in 1901, being 74 per cent of the total quantity reported for the United States. This was an increase of 881,665 tons, or 4 per cent, over the 1900 total of 20,564,238 long tons.

In the Lake Superior region the Marquette range, in the State of Michigan, from which ore was first taken in 1856, has been a constant producer since that time, the total shipments to date being 62,847,473 long tons. Most of this ore is shipped from the ports of Marquette and Escanaba.

The second range to be opened was the Menominee, in the States of Michigan and Wisconsin, in 1877, since which time the total shipments have amounted to 37,621,428 tons, the greater portion being forwarded through the port of Escanaba and a small amount being shipped from Gladstone.

The Gogebic range, in the States of Michigan and Wisconsin, and the Vermilion range in Minnesota, made their initial shipments in the year 1884; but the first-named range has been the larger shipper of ore, the total to the close of 1901 amounting to 34,154,790 long tons, forwarded from the ports of Ashland and Escanaba.

The Vermilion range in Minnesota has shipped from its opening in 1884 to date 16,977,243 long tons, sent from the port of Two Harbors.

The Mesabi range in Minnesota lies south of the Vermilion range, and is the youngest of the five ranges, but owing to the large deposits and the ease of mining some of the ore beds, it has rapidly advanced to a position of preeminence, and in the year 1901 it produced 9,303,541 tons, or 32 per cent of the total for the United States. Since its opening, in the year 1894, this range has shipped a total of 40,404,967 long tons. In addition to the large amounts of ore which the range has already contributed, it has greater reserves of ore apparently than any of the older ranges.

Combining the above totals and adding 2,320 tons for miscellaneous mines, we obtain a grand total for the Lake Superior mines in the United States of 192,008,221 long tons.

A sixth range was opened in Canada in the year 1900, the ore being shipped, principally to the United States, from the port of Michipicoten, in the Province of Ontario. The total output to the close of 1901 amounted to 284,679 tons. It is probable that this range will contribute larger amounts of ore in the future.

The following table shows the annual production of each of the five ranges in the Lake Superior region from 1889 to 1901, inclusive:

Production of Lake Superior iron ores by ranges.

[Maxima in italics.]

Range.	1889.	1890.	1891.	1892.
	Long tons.	*Long tons.*	*Long tons.*	*Long tons.*
Marquette	2,631,026	2,863,848	2,778,482	2,848,552
Menominee	1,876,157	2,274,192	1,856,124	2,402,195
Gogebic	2,147,923	2,914,081	2,041,754	3,058,176
Vermilion	864,508	891,910	945,105	1,226,220
Mesabi	....	....	....	29,245
Total	7,519,614	8,944,031	7,621,465	9,564,388

Production of Lake Superior iron ores by ranges—Continued.

[Maxima in italics.]

Range.	1893.	1894.	1895.	1896.
	Long tons.	*Long tons.*	*Long tons.*	*Long tons.*
Marquette	2,064,827	1,935,379	1,982,080	2,418,846
Menominee	1,563,049	1,255,255	1,794,970	1,763,235
Gogebic	1,466,815	1,523,451	2,625,475	2,100,398
Vermilion	815,735	1,055,229	1,027,103	1,200,907
Mesabi	684,194	1,913,234	2,839,350	3,082,973
Total	6,594,620	7,682,548	10,268,978	10,566,359

Range.	1897.	1898.	1899.	1900.	1901.
	Long tons.	*Long tons.*	*Long tons.*	*Long tons.*	*Long tons.*
Marquette	2,673,785	2,987,930	3,634,596	*3,945,068*	3,597,089
Menominee	1,767,220	2,275,664	3,281,422	3,680,738	*3,697,408*
Gogebic	2,163,088	2,552,205	2,725,648	*3,104,033*	3,041,869
Vermilion	1,381,278	1,125,538	1,643,984	1,675,949	*1,805,996*
Mesabi	4,220,151	4,837,971	6,517,305	8,158,450	*9,303,541*
Total	12,205,522	13,779,308	17,802,955	20,564,238	*21,445,903*

From the above it is seen that in the year 1901 the Mesabi range ranked first, producing 9,303,541 long tons, its maximum output. This total has never been reached by any other iron-ore region in the world, the Bilbao district in Spain being its closest competitor.

In 1901 the Menominee range occupied second place, with a maximum product of 3,697,408 long tons.

The Marquette range showed a decrease from its maximum production of 3,945,068 long tons in 1900 to 3,597,089 tons in 1901.

The Gogebic range also declined from its maximum of 3,104,033 long tons in 1900 to 3,041,869 long tons in 1901.

The Vermilion range reached its maximum of 1,805,996 tons in 1901.

Through the courtesy of the Lake Superior Iron Ore Association the cargo analyses of Lake Superior iron ores shipped in 1901 are given in the following table:

Complete average cargo analyses of Lake Superior iron ores, season of 1901.

GOGEBIC RANGE.

[The upper line of figures opposite each ore represents its analysis when dried at 212° Fahrenheit; the lower line, when in its natural condition.]

Ore.	Iron.	Phosphorus.	Silica.	Manganese.	Alumina.	Lime.	Magnesia.	Sulphur.	Loss by ignition.	Moisture.
	Per ct.	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
Ashland [a]	61.00	0.045	6.85	0.240	3.23	0.360	0.280	0.012	2.30	....
	54.29	.040	6.09	.213	2.87	.320	.249	.010	2.047	11.00
Anvil [a]	63.00	.048	5.80	.90	.97	.25	.17	.005	3.02	....
	55.03	.0419	5.066	.786	.847	.218	.148	.004	2.637	12.65

[a] Expected analysis for the season of 1902.

Complete average cargo analyses of Lake Superior iron ores, season of 1901—Continued.

GOGEBIC RANGE—Continued.

Ore.	Iron.	Phosphorus.	Silica.	Manganese.	Alumina.	Lime.	Magnesia.	Sulphur.	Loss by ignition.	Moisture.
	Per ct.	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
Anvil Special [a]	52.00	0.050	5.80	10.00	0.97	0.25	0.17	0.005	3.02	....
	45.76	.044	5.10	8.80	.85	.22	.149	.004	2.657	12.00
Ardale	56.994	.0554	10.459	.300	4.60	.220	.100	....	2.82	....
	51.0272	.04960	9.3640	.2685	4.118	.1969	.0895	....	2.524	10.469
Atlantic	61.88	.048	....	....	....	....	....	....	....	....
	55.289	.0428	....	....	....	....	....	....	....	10.65
Aurora	62.734	.0339	4.764	.370	1.88	.280	.130	....	2.90	....
	55.2360	.02984	4.1946	.3257	1.655	.2465	.1144	....	2.553	11.952
Best	56.29	.059	12.22	.93	.98	.68	.90	.007	2.90	....
	49.23	.0516	10.687	.81	.857	.59	.787	.006	2.53	12.54
Bonnie	50.23	.038	12.57	6.01	1.69	.17	.70	.019	4.58	....
	45.207	.034	11.31	5.409	1.52	.15	.63	.017	4.12	10.00
Brotherton [a]	62.50	.028	7.35	.35	1.00	.20	.04	.010	1.15	....
	56.25	.0252	6.615	.315	.90	.180	.036	.009	1.035	10.00
Buckeye [a]	58.14	.084	10.50	.43	2.02	.14	.46	.025	....	....
	51.17	.074	9.24	.38	1.88	.12	.41	.022	....	12.00
Cary Empire	58.46	.059	4.75	3.02	.97	.12	.14	.012	5.64	....
	52.5555	.0530	4.2703	2.7150	.8720	.1078	.1259	.0108	5.0704	10.10
Colby Bessemer [a]	64.300	.039	2.720	.260	1.020	.160	.210	.006	1.900	....
	57.857	.035	2.447	.233	.917	.143	.188	.005	1.709	10.020
Colby No. 1	56.700	.066	3.200	6.820	.880	.160	.400	.006	2.200	....
	51.585	.060	2.911	6.204	.800	.145	.363	.005	2.001	9.020
Colby No. 2	60.600	.080	4.000	2.250	1.100	.170	.470	.008	2.150	....
	54.661	.072	3.608	2.029	.992	.153	.423	.007	1.939	9.800
Hennepin	59.30	.049	10.10	.36	1.23	.25	.09	.015	2.70	....
	53.42	.044	9.099	.32	1.108	.225	.081	.0135	2.43	9.91
Iron Belt [a]	60.50	.045	8.75	.36	1.50	.35	.39	.030	3.90	....
	53.32	.040	7.71	.32	1.32	.31	.34	.027	3.40	11.86
Ironton	61.120	.051	6.700	.920	1.400	.360	.120	.004	2.900	....
	54.641	.045	5.989	.822	1.251	.321	.107	.003	2.592	10.600
Jack Pot	52.90	.035	....	....	....	....	....	....	....	....
	46.05	.030	....	....	....	....	....	....	....	12.95
Lawrence	62.21	.055	4.62	.30	1.34	.19	.11	.018	3.98	....
	55.44	.049	4.12	.27	1.20	.17	.10	.016	3.55	10.87
Lyon	58.44	.048	....	....	....	....	....	....	....	....
	53.31	.0447	....	....	....	....	....	....	....	8.77
Melrose [a]	62.00	.040	5.35	.95	1.08	.17	.13	.011	3.31	....
	55.40	.0357	4.78	.848	.964	.15	.116	.0098	2.957	10.65
Melrose No. 2 [a]	62.00	.070	5.15	....	1.08	.17	.13	.011	3.31	....
	55.40	.062	4.60	....	.964	.15	.116	.0098	2.957	10.65
Meteor	60.100	.039	8.700	.560	.900	.620	.090	.004	2.260	....
	53.639	.034	7.764	.499	.803	.553	.080	.003	2.017	10.750
Mikado	57.29	.151	13.90	.32	1.01	.42	.18	.011	1.55	....
	50.3121	.1326	12.2070	.2810	.8870	.3688	.1581	.0097	1.3612	12.18
Montreal [a]	62.86	.045	4.47	.43	1.18	.20	.13	.012	....	....
	56.15	.040	3.99	.38	1.05	.18	.12	.011	....	10.68
New Davis [a]	48.00	.055	11.02	10.00	....	....	....	....	....	....
	44.16	.051	10.14	9.20	....	....	....	....	....	8.00
New Era [a]	58.00	.035	10.05	.90	1.23	.26	.14	.011	4.41	....
	51.27	.0309	8.883	.795	1.087	.229	.12	.0097	3.897	11.61

[a] Expected analysis for the season of 1902.

Complete average cargo analyses of Lake Superior iron ores, season of 1901—Continued.

GOGEBIC RANGE—Continued.

Ore.	Iron.	Phosphorus.	Silica.	Manganese.	Alumina.	Lime.	Magnesia.	Sulphur.	Loss by ignition.	Moisture.
	Per ct.	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
New Era No. 2 [a]	58.00	0.075	10.05	0.90	1.23	0.26	0.14	0.011	4.41	....
	51.27	.066	8.88	.795	1.087	.229	.12	.0097	3.897	11.61
Newport	53.23	.041	6.24	8.12	.81	.22	.18	.008	5.15	....
	47.60	.0366	5.58	7.26	.72	.196	.16	.007	4.60	10.57
Norrie	63.425	.0405	3.994	.400	1.90	.320	.120	....	2.60	....
	56.5662	.03612	3.5620	.3567	1.694	.2853	.1070	....	2.318	10.814
Norrie Norden	63.995	.0804	2.992	.350	1.48	.240	.090	....	3.30	....
	57.8124	.07263	2.7029	.3161	1.337	.2168	.0813	....	2.981	9.661
Nordale	58.268	.0362	10.052	.310	3.43	.220	.100	....	2.66	....
	52.2553	.03246	9.0147	.2780	3.076	.1972	.0896	....	2.385	10.319
Ottawa [a]	58.10	.067	6.14	2.72	1.58	.05	.16	.005	4.74	....
	52.00	.060	5.50	2.43	1.41	.04	.14	.004	4.24	10.50
Ottawa Manganese [a]	54.95	.074	4.25	6.29	1.01	.15	.21	.031	6.50	....
	49.18	.066	3.80	5.63	.91	.13	.18	.028	5.81	10.50
Puritan	57.200	.038	6.200	4.020	1.400	.420	.120	.006	2.900	....
	50.679	.033	5.493	3.561	1.240	.372	.106	.005	2.569	11.400
Rand	63.43	.0397	2.58	1.99	1.22	.47	.35	....	2.83	....
	55.361	.03465	2.251	1.736	1.064	.410	.305	....	2.470	12.72
Rowe [a]	57.00	.040	11.25	.90	.70	.23	.19	.02	2.75	....
	49.59	.0348	9.787	.78	.609	.20	.165	.017	2.39	13.00
Sunday Lake [a]	62.50	.028	7.10	.30	.95	.25	.05	.010	1.04	....
	56.25	.0252	6.390	.270	.855	.225	.045	.009	.936	10.00
Taylor [a]	58.00	.052	8.40	.230	3.52	.260	.150	.014	3.20	....
	52.20	.0468	7.56	.207	3.168	.234	.135	.0126	2.88	10.00
Tilden	63.88	.0497	2.99	.77	1.29	.53	.37	....	2.68	....
	55.505	.04318	2.598	.669	1.120	.460	.321	....	2.328	13.11
Tilden Norden	63.82	.0756	3.00	.76	1.30	.56	.44	....	2.59	....
	55.293	.06549	2.599	.658	1.126	.485	.381	....	2.243	13.36
Winona	57.200	.046	8.000	2.180	.900	.210	.090	.006	2.180	....
	51.036	.041	7.152	1.948	.804	.187	.080	.005	1.948	10.600

MARQUETTE RANGE.

Abbotsford	62.88	0.030	7.41	0.13	1.59	0.112	0.151	....	0.33	....
	62.053	.0296	7.312	.128	1.569	.1105	.1490	....	.325	1.315
Alford	63.70	.048	5.86	.26	1.64	.149	.169	....	1.05	....
	56.851	.0428	5.229	.232	1.463	.1329	.1508	....	.937	10.751
Angeline, Hard	67.41	.011	....	....	....	....	....	....	....	....
	63.65	.010	....	....	....	....	....	....	....	5.57
Angeline, Hard No. 1 B	67.18	.014	....	....	....	....	....	....	....	....
	64.49	.013	....	....	....	....	....	....	....	4.00
Angeline, Hematite	65.13	.041	....	....	....	....	....	....	....	....
	57.85	.036	....	....	....	....	....	....	....	11.17
Angeline, South	61.70	.079	6.85	.32	1.52	.25	.13	0.022	3.67	....
	54.94	.070	6.10	.28	1.35	.22	.12	.020	3.27	10.96
Averhart [a]	61.47	.020	9.97	....	....	....	....	....	....	....
	59.472	.0193	9.645	....	....	....	....	....	....	3.25
Barrow	42.43	.040	33.46	....	....	....	....	....	....	....
	38.90	.037	30.68	....	....	....	....	....	....	8.31
Beaufort	52.00	.257	5.07	.24	.98	3.42	2.63	.086	11.68	....
	47.94	.237	4.68	.22	.90	3.15	2.43	.079	10.77	7.79

[a] Expected analysis for the season of 1902.

Complete average cargo analyses of Lake Superior iron ores, season of 1901—Continued.

MARQUETTE RANGE—Continued.

Ore.	Iron.	Phosphorus.	Silica.	Manganese.	Alumina.	Lime.	Magnesia.	Sulphur.	Loss by ignition.	Moisture.
	Per ct.	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
Bessie [a]	53.47	0.432	12.07	....	....	....	....	....	....	....
	51.732	.4179	11.677	....	....	....	....	....	....	3.25
Bell	40.00	.034	38.25	0.21	1.28	0.13	0.16	0.028	2.29	....
	39.09	.033	37.38	.20	1.25	.127	.156	.027	2.238	2.26
Bedford	60.16	.140	7.80	.61	1.26	.335	.519	....	3.28	....
	53.301	.1240	6.910	.540	1.116	.2968	.4598	....	2.906	11.40
Beresford	63.47	.106	4.97	.13	2.48	.298	.432	....	.43	....
	63.081	.1053	4.939	.129	2.464	.2961	.4293	....	.427	.612
Beresford Lump	64.60	.107	3.51	.13	2.22	.335	.378	....	.40	....
	64.240	.1064	3.490	.129	2.207	.3331	.3758	....	.397	.556
Bernhart [a]	58.02	.075	9.04	....	....	....	....	....	....	....
	53.993	.0697	8.412	....	....	....	....	....	....	6.94
Bigelow	51.00	.050	22.04	.12	2.10	.26	.12	.016	2.53	....
	46.41	.045	20.056	.109	1.91	.236	.109	.014	2.30	9.00
Buffalo	61.65	.099	5.05	.309	2.74	.94	.817	.091	1.979	....
	54.202	.0870	4.439	.2716	2.409	.826	.7183	.0800	1.7399	12.080
Cambria [a]	60.41	.053	6.64	.98	2.63	.90	.32	.010	2.71	....
	53.698	.047	5.90	.87	2.337	.80	.28	.0088	2.408	11.11
Cambridge	59.50	.668	6.03	.718	1.513	1.80	.461	.010	1.97	....
	50.66	.568	5.13	.611	1.288	1.53	.392	.008	1.66	14.85
Cameo	58.08	.1009	7.03	.313	4.84	1.17	1.06	.109	2.511	....
	51.316	.08915	6.211	.2765	4.276	1.033	.936	.0963	2.2185	11.645
Castleford	56.90	.087	13.80	.13	2.75	.279	.447	....	.52	....
	56.234	.0859	13.638	.128	2.717	.2757	.4417	....	.513	1.170
Champion No. 1, crushed [a]	64.00	.060	4.55	.20	2.38	.32	.29	.013	....	....
	63.49	.0595	4.51	.198	2.36	.317	.288	.0129	....	.80
Champion B, crushed [a]	60.30	.058	8.96	.23	2.78	.38	.26	.018	....	....
	59.73	.0574	8.87	.228	2.75	.376	.258	.0178	....	.95
Champion, hematite	52.25	.397	9.84	.28	1.67	3.16	1.81	.053	6.35	....
	47.76	.363	8.99	.256	1.53	2.89	1.65	.048	5.80	8.60
Chatford	50.96	.114	21.10	.31	1.35	.186	.169	....	3.39	....
	46.750	.1045	19.357	.284	1.238	.1706	.1550	....	3.109	8.260
Chester, No. 1	45.35	.061	28.54	.33	1.75	.89	.65	.009	1.78	....
	41.85	.0567	26.5422	.3069	1.6275	.8277	.6045	.0083	1.6554	6.95
Chester, No. 2	40.80	.030	36.16	.478	1.422	.22	.25	.006	2.12	....
	38.72	.02805	33.809	.4469	1.3296	.2057	.2338	.0056	1.982	6.50
Cliffs Shaft, crush'd	61.90	.098	4.48	.24	2.19	1.28	.97	.021	.63	....
	61.24	.0969	4.43	.237	2.166	1.266	.959	.0207	.623	1.06
Cliffs Shaft, lump	63.49	.087	3.30	.25	1.88	1.23	.84	.019	.56	....
	63.22	.0866	3.286	.248	1.872	1.224	.836	.0189	.557	.42
Comrade [a]	55.10	.112	12.36	.106	4.15	.561	1.98	.025	1.29	....
	54.50	.1107	12.23	.1048	4.10	.555	1.96	.0247	1.275	1.09
Derhart [a]	47.01	.020	29.91	....	....	....	....	....	....	....
	45.590	.0193	29.006	....	....	....	....	....	....	3.02
East New York	59.38	.046	9.17	.14	2.48	.39	.41	.017	1.77	....
	52.759	.0408	8.147	.12	2.20	.346	.36	.015	1.57	11.15
Imperial [a]	52.44	.256	13.49	.198	1.20	1.37	1.39	.011	7.38	....
	47.03	.229	12.10	.177	1.076	1.228	1.246	.009	6.62	10.32
Jackson, South	42.50	.082	29.60	2.82	1.65	.14	.07	.018	3.50	....
	38.9428	.0751	27.1225	2.5840	1.5119	.1283	.0641	.0165	3.2071	8.37

[a] Expected analysis for the season of 1902.

Complete average cargo analyses of Lake Superior iron ores, season of 1901—Continued.

MARQUETTE RANGE—Continued.

Ore.	Iron.	Phosphorus.	Silica.	Manganese.	Alumina.	Lime.	Magnesia.	Sulphur.	Loss by ignition.	Moisture.
	Per ct.	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
Lake	59.70	0.125	5.73	0.490	2.82	0.50	0.54	0.013	3.71	....
	51.90	.1086	4.981	.425	2.451	.434	.469	.0113	3.225	13.07
Lake Bessemer	64.03	.040	5.26	.230	1.25	.260	.130	.011	1.50	....
	56.48	.035	4.64	.203	1.10	.229	.114	.009	1.32	11.79
Lillie	60.85	.085	6.16	.34	2.10	.41	.09	.013	3.34	....
	53.35	.074	5.388	.297	1.837	.358	.078	.0110	2.92	12.52
Michigamme	59.20	.104	11.70	.19	2.23	.84	1.01	.025	.150	....
	58.45	.102	11.54	.187	2.20	.829	.997	.024	.148	1.26
Mitchell	60.88	.156	....	....	....	....	....	....	....	....
	53.88	.138	....	....	....	....	....	....	....	11.50
Moore[a]	41.60	.019	37.48	.29	1.21	.69	.48	.035	.42	....
	40.457	.0184	36.450	.282	1.176	.671	.466	.0340	.408	2.747
Negaunee[a]	59.60	.062	7.4	.35	2.88	.99	.608	.067	1.98	....
	52.815	.0549	6.55	.310	2.552	.877	.5387	.0593	1.754	11.383
Norfolk, Bessemer, crushed.	55.55	.055	15.26	.27	3.35	.38	.21	.034	.15	....
	54.91	.0543	15.08	.267	3.31	.376	.208	.0336	.148	1.15
Norfolk, non-Bessemer, crushed.	57.17	.126	13.91	.27	3.08	.38	.21	.034	.15	....
	56.51	.1245	13.75	.267	3.04	.376	.208	.0336	.148	1.15
Princeton No. 1	64.40	.047	2.30	.43	1.37	1.05	.93	.021	1.60	....
	53.94	.039	1.926	.36	1.147	.879	.778	.017	1.34	16.24
Princeton No. 2	60.27	.124	7.70	.57	1.50	.65	.518	.016	1.98	....
	49.95	.102	6.38	.46	1.23	.538	.429	.013	1.64	17.12
Republic, crushed[a]	65.50	.046	4.00	....	....	....	....	....	....	....
	64.84	.0455	3.960	....	....	....	....	....	....	1.00
Republic, Kingston	62.62	.045	7.21	.12	1.42	.42	.30	.027	.31	....
	61.94	.0445	7.132	.118	1.404	.415	.296	.0267	.306	1.08
Republic, Magnetic (N. B.)[a]	69.00	....	2.50	.147	.664	.20	.216	.021	.46	....
	68.31	....	2.47	.145	.657	.198	.213	.0207	.455	1.00
Republic, Specular	67.41	.040	2.31	Trace	.747	.22	.15	.025	.23	....
	66.74	.0396	2.286	Trace	.7395	.217	.148	.0247	.227	1.00
Richmond	43.600	.034	36.200	.040	.640	.490	.110	.004	2.740	....
	43.046	.033	35.740	.039	.631	.483	.108	.003	2.705	1.270
Rose	60.50	.150	6.41	.33	2.45	.50	.18	.029	2.16	....
	54.45	.135	5.769	.297	2.20	.45	.16	.026	1.94	10.00
Salisbury	60.42	.112	7.00	.29	2.31	.56	.56	.012	2.22	....
	52.56	.097	6.089	.252	2.009	.487	.487	.0104	1.931	13.01
Scotch[a]	58.50	.122	10.19	.105	3.92	.586	.874	.019	.730	....
	57.92	.1207	10.08	.104	3.88	.580	.865	.0188	.722	1.00
Sheffield	59.72	.028	....	....	....	....	....	....	....	....
	57.45	.027	....	....	....	....	....	....	....	3.80
Tilden, silica	42.10	.031	38.10	.06	.83	.25	.10	.010	.27	....
	41.35	.030	37.42	.058	.815	.24	.098	.0098	.265	1.78

MENOMINEE RANGE.

Atfield	60.58	0.055	6.18	0.078	2.48	0.84	0.62	0.22	2.42	....
	54.402	.0493	5.549	.0700	2.227	.754	.556	.197	2.173	10.197
Armenia	58.700	.226	6.950	.200	1.180	2.190	1.020	.004	3.100	....
	52.653	.202	6.234	.179	1.058	1.964	.914	.003	2.780	10.300
Ajax	52.10	.0575	14.60	.4272	1.76	1.55	3.34	.005	2.70	....
	48.677	.0537	13.640	.3991	1.644	1.448	3.120	.0046	2.522	6.57

[a] Expected analysis for the season of 1902.

Complete average cargo analyses of Lake Superior iron ores, season of 1901—Continued.

MENOMINEE RANGE—Continued.

Ore.	Iron.	Phosphorus.	Silica.	Manganese.	Alumina.	Lime.	Magnesia.	Sulphur.	Loss by ignition.	Moisture.
	Per ct.	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
Bangor[a]	59.00	0.46	6.50	0.23	1.99	0.61	0.90	0.050	4.15	....
	51.92	.40	5.72	.20	1.75	.536	.79	.044	3.65	12.00
Baltic	59.35	.456	3.79	.26	3.13	.39	.43	.052	5.55	....
	53.9195	.4143	3.4432	.2362	2.8436	.3543	.3907	.0472	5.0422	9.15
Barfield	58.57	.074	8.15	.129	2.68	.924	.67	.234	3.10	....
	52.363	.0661	7.286	.1153	2.396	.8260	.599	.2092	2.771	10.597
Barton	59.09	.416	4.71	.640	2.32	.66	.533	.035	5.50	....
	56.460	.3974	4.500	.6115	2.216	.630	.5092	.033	5.255	4.45
Basic	56.880	.360	4.140	4.900	1.650	2.200	1.180	.006	2.900	....
	52.557	.332	3.825	4.527	1.524	2.032	1.090	.005	2.679	7.600
Bristol	56.70	.496	5.24	.94	1.83	1.54	.50	.022	6.72	....
	52.45	.458	4.85	.87	1.69	1.42	.46	.020	6.21	7.50
Brunswick	57.81	.520	4.86	.250	3.10	1.37	.853	.016	4.44	....
	50.820	.4571	4.272	.2197	2.725	1.204	.7498	.0140	3.903	12.09
Chapin	59.30	.0615	6.25	.4124	1.17	1.34	2.87	.004	2.55	....
	55.368	.0574	5.835	.3850	1.092	1.251	2.679	.0037	2.380	6.63
Clearfield	59.18	.047	6.13	.067	2.37	1.48	.69	.495	3.43	....
	52.377	.0415	5.425	.0592	2.097	1.309	.610	.4380	3.035	11.495
Clifford	41.00	.012	39.79	.12	.81	.20	.09	.010	.68	....
	39.85	.012	38.67	.12	.79	.19	.09	.009	.66	2.82
Crystal Falls	58.650	.772	4.270	.380	1.820	2.600	1.060	.006	2.200	....
	53.606	.705	3.902	.347	1.663	2.376	.968	.005	2.010	8.600
Davidson[a]	56.06	.130	7.29	.35	3.76	1.08	2.85	.120	....	....
	49.89	.116	6.49	.31	3.35	.96	2.50	.106	....	11.00
Davy[a]	41.50	.021	38.08	.08	.33	.60	.85	.02	.66	....
	41.08	.0207	37.699	.079	.326	.59	.84	.019	.65	1.00
Florence	55.00	.292	6.05	.50	3.95	2.30	3.34	.11	5.23	....
	49.87	.264	5.486	.45	3.58	2.08	3.028	.099	4.74	9.32
Granada	60.75	.0605	5.35	.153	1.39	.98	3.17	.019	2.17	....
	56.029	.0557	4.934	.1411	1.281	.903	2.923	.0175	2.001	7.77
Gray	43.91	.038	23.88	.53	1.91	....	....	.062	4.70	....
	43.466	.0376	23.638	.524	1.890	....	....	.0613	4.652	1.01
Groveland No. 1	52.030	.046	10.870	1.370	2.700	6.200	4.720	.008	3.260	....
	48.700	.043	10.174	1.282	2.527	5.803	4.417	.007	3.051	6.400
Groveland No. 2[a]	51.100	.058	19.070	1.530	3.090	2.850	4.680	.018	6.300	....
	47.931	.054	17.887	1.435	2.898	2.673	4.389	.016	5.909	6.200
Great Western	59.040	.327	6.800	.900	1.760	2.180	.960	.007	2.970	....
	53.903	.298	6.208	.821	1.606	1.990	.876	.006	2.711	8.700
Hemlock	55.97	.257	6.14	.32	2.88	2.36	1.89	.012	4.50	....
	53.3450	.2449	5.8520	.3050	2.7449	2.2493	1.8014	.0114	4.2890	4.69
Hiawatha	57.34	.184	7.08	.46	1.60	.328	.28	.017	....	....
	53.326	.1711	6.584	.42	1.488	.3020	.2604	.0158	....	7.00
Hope[a]	59.00	.325	8.00	....	....	....	....	....	....	....
	51.920	.2860	7.040	....	....	....	....	....	....	12.00
Keel Ridge[a]	40.64	.046	37.42	.20	.90	1.35	1.00	.006	....	....
	39.46	.045	36.33	.19	.87	1.31	.97	.006	....	2.90
Kimball[a]	57.200	.660	4.300	.210	1.600	2.600	1.800	.006	3.020	....
	52.624	.607	3.956	.193	1.472	2.392	1.656	.005	2.778	8.000
Lamont	57.600	.720	4.150	.580	1.240	2.610	1.100	.006	2.100	....
	52.704	.658	3.797	.530	1.134	2.388	1.006	.005	1.921	8.500

[a] Expected analysis for the season of 1902.

Complete average cargo analyses of Lake Superior iron ores, season of 1901—Continued.

MENOMINEE RANGE—Continued.

Ore.	Iron.	Phosphorus.	Silica.	Manganese.	Alumina.	Lime.	Magnesia.	Sulphur.	Loss by ignition.	Moisture.
	Per ct.	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
Lerida	61.65	0.0853	5.22	0.131	1.36	0.92	2.25	0.015	2.08	....
	56.810	.0786	4.810	.1207	1.253	.847	2.073	.0138	1.916	7.85
Lincoln	58.800	.340	6.900	.660	1.800	1.600	1.180	.008	2.720	....
	54.037	.312	6.341	.606	1.654	1.470	1.084	.007	2.499	8.100
Loretto	59.00	.022	11.16	.17	1.71	.13	.70	.023	.79	....
	53.60	.0199	10.139	.15	1.55	.39	.636	.0208	.717	9.14
Manganate	51.55	.550	6.05	3.30	2.78	2.08	1.60	.042	7.34	....
	47.73	.509	5.60	3.06	2.57	1.93	1.48	.038	6.80	7.41
Monongahela Non-Bessemer	52.33	.109	15.59	.23	3.84	.29	.50	.020	3.50	....
	47.25	.098	14.08	.21	3.47	.26	.45	.018	3.16	9.70
Michigan No. 1[a]	57.50	.225	4.50	....	....	....	....	....	....	....
	53.762	.2103	4.207	....	....	....	....	....	....	6.50
Michigan No. 2[a]	53.50	.325	7.50	....	....	....	....	....	....	....
	48.685	.2957	6.825	....	....	....	....	....	....	9.00
Paint River[a]	57.400	.660	6.100	.400	1.900	1.960	1.410	.008	3.600	....
	51.086	.587	5.429	.356	1.691	1.744	1.254	.007	3.204	11.000
Pewabic	64.37	.012	4.75	.13	.99	.57	1.22	.001	1.03	....
	59.3491	.0110	4.3795	.1199	.9128	.5255	1.1248	.0009	.9497	7.80
Pewabic Genoa	43.21	.010	30.69	.10	1.62	.72	1.37	.005	1.29	....
	40.6520	.0094	28.8732	.0941	1.5241	.6774	1.2889	.0047	1.2136	5.92
Quinnesec No. 1[a]	62.100	.034	4.020	.220	.600	.200	.220	.006	2.200	....
	58.684	.032	3.798	.207	.567	.189	.207	.005	2.079	5.500
Quinnesec Non-Bessemer	62.200	.112	4.100	.210	.700	.200	.260	.006	2.180	....
	59.002	.106	3.889	.199	.664	.189	.246	.005	2.067	5.140
Quinnesec (Silicious Bessemer)	44.800	.032	30.100	.120	1.090	.260	.380	.004	2.720	....
	43.823	.031	29.443	.117	1.066	.254	.371	.003	2.660	2.180
Russell	54.40	.061	9.66	.37	2.56	2.35	3.40	.019	3.20	....
	50.12	.056	8.90	.34	2.358	2.16	3.13	.017	2.948	7.86
San Jose	65.40	.014	3.64	.16	1.18	.24	.38	.013	.52	....
	59.827	.0128	3.329	.146	1.079	.219	.347	.0118	.47	8.52
Tobin[a]	60.180	.240	6.400	.220	1.410	1.320	.980	.004	2.920	....
	55.004	.219	5.849	.201	1.288	1.206	.895	.003	2.668	8.600
Toledo	55.01	.012	16.44	.11	1.36	.81	1.36	.004	1.31	....
	51.0548	.0111	15.2580	.1021	1.2622	.7518	1.2622	.0037	1.2158	7.19
Tyrone	59.87	.073	7.46	.16	1.37	1.66	2.45	.002	2.66	....
	55.6492	.06785	6.9341	.1487	1.2734	1.5430	2.2773	.0019	2.4725	7.05
Vivian[a]	42.00	.008	36.42	.10	1.07	.60	.99	.002	.86	....
	....	....	....	....	....	....	....	....	....	....
Walpole	57.61	.118	9.82	.15	2.32	.22	1.23	.003	2.05	....
	53.9287	.1105	9.1925	.1404	2.1718	.2059	1.1514	.0028	1.9190	6.39

MESABI RANGE.

Ore.	Iron.	Phosphorus.	Silica.	Manganese.	Alumina.	Lime.	Magnesia.	Sulphur.	Loss by ignition.	Moisture.
Adams	62.75	0.034	3.49	0.706	1.08	0.148	0.080	0.065	4.57	....
	56.719	.0307	3.154	.6381	.976	.1337	.0723	.0587	4.130	9.61
Adams Special	63.61	.032	3.09	.574	1.30	.119	.079	.047	3.87	....
	57.497	.0289	2.793	.5188	1.175	.1075	.0714	.0424	3.498	9 61
Adams No. 2	59.93	.069	4.09	.662	2.29	.130	.088	.073	6.79	....
	50.940	.0586	3.476	.5627	1.946	.1105	.0748	.0620	5.771	15.00
Admiral	63.800	.027	4.900	.300	.620	.230	.180	.006	2.140	....
	58.823	.024	4.517	.276	.571	.212	.165	.005	1.973	7.800

[a] Expected analysis for the season of 1902.

Complete average cargo analyses of Lake Superior iron ores, season of 1901—Continued.

MESABI RANGE—Continued.

Ore.	Iron.	Phosphorus.	Silica.	Manganese.	Alumina.	Lime.	Magnesia.	Sulphur.	Loss by ignition.	Moisture.
	Per ct.	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
Atlas	60.53	0.057	5.70	1.07	1.03	0.20	0.10	0.013	4.73	....
	54.2228	.0511	5.1061	.9585	.9227	.1792	.0896	.0116	4.2371	10.42
Audrey	61.66	.054	4.20	.54	2.30	.38	.20	.002	4.16	....
	53.311	.0466	3.631	.466	1.988	.328	.172	.0017	3.596	13.54
Beaver	63.85	.078	2.35	.33	1.54	.18	.12	.011	3.95	....
	57.24	.0699	2.106	.29	1.38	.16	.107	.0098	3.54	10.35
Biwabik	63.55	.038	3.10	.45	.95	.19	.11	.009	4.13	....
	58.64	.035	2.86	.415	.876	.175	.10	.008	3.81	7.72
Butler	62.59	.053	2.52	.50	1.02	.41	.28	.015	5.08	....
	56.88	.048	2.29	.454	.926	.372	.254	.013	4.61	9.12
Chisholm[a]	64.30	.039	3.36	1.15	1.02	.18	.20	.006	....	....
	57.471	.0348	3.003	1.027	.911	.160	.178	.0053	....	10.62
Clark[a]	62.82	.034	4.68	1.04	.96	.23	.18	.005	....	....
	56.148	.0303	4.182	.929	.858	.205	.160	.0044	....	10.62
Commodore	63.100	.039	4.150	.200	1.210	.240	.060	.004	3.400	....
	57.231	.035	3.764	.181	1.097	.217	.054	.003	3.083	9.300
Columbia	57.52	.066	8.89	.56	3.94	.13	.13	.016	4.58	....
	49.28	.056	7.62	.48	3.37	.11	.11	.014	3.92	14.33
Corsica[a]	61.00	.045	....	....	....	....	....	....	....	....
	54.21	.0400	....	....	....	....	....	....	....	11.10
Croxton[a]	60.00	.060	....	....	....	....	....	....	....	....
	54.60	.0546	....	....	....	....	....	....	....	9.00
Dailey[a]	61.03	.038	6.11	.71	.92	.21	.18	.043	5.17	....
	51.51	.032	5.157	.599	.776	.177	.15	.036	4.36	15.59
Duluth	59.93	.053	5.23	.883	1.62	.118	.109	.010	6.33	....
	52.492	.0464	4.580	.7734	1.418	.1033	.0954	.0087	5.544	12.41
Elba	61.70	.039	3.84	.93	.89	.10	.17	.010	5.20	....
	55.7891	.03526	3.4721	.8409	.8047	.0904	.1537	.0090	4.7018	9.58
Fayal	63.80	.037	2.95	.65	.75	.40	.15	.004	3.69	....
	57.860	.0335	2.675	.589	.680	.362	.136	.0036	3.346	9.31
Franklin	60.035	.0381	....	....	....	....	....	....	....	....
	55.558	.0352	....	....	....	....	....	....	....	7.457
Genoa	62.88	.032	4.62	.46	.77	.44	.22	.007	3.44	....
	56.453	.0287	4.147	.412	.691	.395	.197	.0062	3.088	10.22
Hartley	63.45	.042	3.65	.552	1.24	.150	.028	.008	3.50	....
	57.606	.0381	3.313	.5011	1.125	.1361	.0254	.0072	3.177	9.21
Hibbing	64.62	.033	2.84	.507	1.32	.155	.083	.007	2.56	....
	57.899	.0295	2.544	.4542	1.182	.1388	.0743	.0062	2.293	10.40
Island	61.40	.066	3.43	.56	.91	.49	.23	.013	5.96	....
	54.179	.0582	3.026	.494	.802	.432	.202	.0114	5.259	11.76
Jordan[a]	63.600	.059	4.200	.260	1.050	.280	.180	.006	2.760	....
	57.685	.053	3.809	.235	.952	.253	.163	.005	2.503	9.300
Juniata	61.45	.054	5.35	.280	2.43	.115	.075	.011	3.65	....
	53.305	.0468	4.640	.2428	2.107	.0997	.0650	.0095	3.166	13.254
Kanawha and Hale	59.10	.069	8.78	.45	1.19	.95	.14	.010	2.09	....
	53.0718	.0619	7.884	.4041	1.0686	.8531	.1257	.0088	1.8768	10.20
Longyear Bessemer[a]	61.00	.050	....	....	....	....	....	....	....	....
	55.51	.0455	....	....	....	....	....	....	....	9.00
Longyear Non-Bessemer[a]	60.00	.070	6.50	.49	1.21	.25	.17	.010	....	....
	54.60	.0637	5.915	.4459	1.0031	.2275	.1547	.0091	....	9.00

[a] Expected analysis for the season of 1902.

Complete average cargo analyses of Lake Superior iron ores, season of 1901—Continued.

MESABI RANGE—Continued.

Ore.	Iron.	Phosphorus.	Silica.	Manganese.	Alumina.	Lime.	Magnesia.	Sulphur.	Loss by ignition.	Moisture.
	Per ct.	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
Mahoning	64.66	0.047	2.45	0.39	1.46	0.14	0.12	0.008	2.97	....
	57.93	.042	2.19	.349	1.308	.12	.107	.007	2.66	10.40
Malta	63.52	.030	4.70	.78	.63	.12	.12	.013	2.80	....
	58.1526	.02747	4.3029	.7141	.5768	.1099	.1099	.0119	2.5634	8.45
Minorca [a]	61.73	.032	....	....	....	....	....	....	....	....
	....	....	....	....	....	....	....	....	....	....
Morrow [a]	60.00	.060	5.50	.47	1.32	.12	.08	.027	....	....
	54.90	.0549	5.0325	.43	1.2078	.1098	.0732	.0247	....	8.50
Mountain	63.78	.0415	3.95	.219	1.95	.106	.070	.014	2.35	....
	55.833	.03632	3.457	.1917	1.707	.0927	.0612	.0122	2.057	12.459
Oliver	62.64	.0498	4.63	.232	2.18	.096	.087	.015	3.04	....
	54.702	.04348	4.043	.2026	1.903	.0838	.0759	.0130	2.654	12.671
Pearce [a]	63.00	.035	3.17	1.10	1.01	.18	.20	.007	....	....
	56.70	.0315	2.853	.990	.909	.162	.180	.0063	....	10.00
Penobscot	59.82	.040	7.22	.88	1.93	.20	.14	.10	3.53	....
	53.18	.035	6.419	.78	1.71	.177	.12	.088	3.138	11.09
Pillsbury No. 1	62.07	.030	4.28	.507	1.23	.090	.171	.008	4.84	....
	56.707	.0274	3.910	.4631	1.123	.0822	.1562	.0073	4.421	8.64
Pillsbury No. 2	59.04	.055	4.92	.750	1.28	.118	.215	.010	8.23	....
	52.191	.0486	4.349	.6630	1.131	.1043	.1900	.0088	7.275	11.60
Preble	60.67	.063	6.22	.325	2.63	.116	.065	.013	3.63	....
	52.412	.0544	5.373	.2807	2.272	.1002	.0561	.0112	3.135	13.611
Roberts	60.95	.025	7.90	.45	1.13	.25	.08	.040	2.10	....
	55.525	.0227	7.196	.4099	1.0294	.2277	.0728	.0364	1.9131	8.90
Sauntry No. 1 [a]	61.68	.053	5.94	.50	1.88	.21	.11	.006	....	....
	56.221	.0483	5.414	.455	1.713	.191	.100	.0054	....	8.85
Sauntry No. 2 [a]	61.64	.079	6.03	.80	2.07	.29	.11	.005	....	....
	56.184	.0720	5.496	.729	1.886	.264	.102	.0045	....	8.85
Shilling	62.17	.062	2.78	.53	1.06	.22	.07	.013	6.09	....
	55.25	.055	2.47	.47	.942	.195	.06	.011	5.41	11.13
Sparta	61.63	.025	7.75	.40	.69	.15	.26	.019	2.35	....
	56.3298	.02285	7.0835	.3656	.6307	.1371	.2376	.0174	2.1479	8.60
Stephens [a]	60.00	.070	3.75	....	....	....	....	....	....	....
	54.000	.0630	3.375	....	....	....	....	....	....	10.00
Steese	62.64	.037	2.48	1.07	1.22	.12	.05	.007	4.87	....
	57.86	.034	2.29	.988	1.127	.11	.046	.006	4.498	7.62
Stevenson	64.890	.036	3.020	.310	.720	.260	.180	.005	2.720	....
	59.504	.033	2.769	.284	.660	.238	.165	.004	2.494	8.300
Thompson	63.01	.036	3.34	.607	.82	.185	.113	.027	4.66	....
	55.600	.0317	2.947	.5356	.723	.1592	.0997	.0238	4.111	11.76
Top Brown	60.99	.066	5.30	.88	.95	.15	.24	.018	4.43	....
	54.8788	.05939	4.7689	.7918	.8548	.1350	.2160	.0162	3.9861	10.02
Tubal	61.19	.060	4.45	.938	2.57	.168	.062	.016	4.18	....
	52.953	.0519	3.851	.8117	2.224	.1453	.0536	.0138	3.617	13.46
Union [a]	60.54	.041	....	....	....	....	....	....	....	....
	55.63	.0376	....	....	....	....	....	....	....	8.11
Wallace	61.850	.055	2.100	.370	.900	.180	.210	.008	2.900	....
	58.559	.049	1.896	.334	.812	.162	.189	.007	2.618	9.700
Welsh	61.45	.055	3.35	.61	1.07	.47	.24	.016	5.79	....
	54.432	.0487	2.927	.540	.947	.116	.212	.0141	5.128	11.42

[a] Expected analysis for the season of 1902.

Complete average cargo analyses of Lake Superior iron ores, season of 1901—Continued.

VERMILION RANGE.

Ore.	Iron.	Phosphorus.	Silica.	Manganese.	Alumina.	Lime.	Magnesia.	Sulphur.	Loss by ignition.	Moisture.
	Per ct.	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
Chandler	64.42	0.040	4.21	0.10	1.99	0.38	0.20	Trace.	0.98	....
	61.224	.0380	4.001	.095	1.891	.361	.190	Trace.	.931	4 96
Jura	61.02	.078	4.31	.156	2.67	1.16	....	....	4.07	....
	56.779	.0725	4.010	.1451	2.484	1.079	....	....	3.787	6.95
Long Lake	60.64	.043	7.68	.14	3.26	.40	.35	Trace.	1.43	....
	56.722	.0402	7.183	.130	3.049	.374	.327	Trace.	1.337	6.46
Pioneer	63.11	.040	5.66	.139	2.55	.074	.017	....	1.35	....
	59.108	.0374	5.301	.1226	2.388	.0693	.0159	....	1.264	6.34
Pilot	67.03	.032	2.23	.069	1.04	.051	.008	....	.49	....
	65.555	.0312	2.180	.0674	1.017	.0498	.0078	....	.479	2.20
Red Lake	61.45	.122	6.73	.09	2.49	.61	.64	.019	.93	....
	59.723	.1185	6.540	.087	2.420	.592	.622	.0184	.903	2.81
Savoy	63.76	.051	3.46	.080	2.38	.248	....	....	2.68	....
	59.532	.0476	3.230	.0746	2.222	.2315	....	....	2.502	6.63
Sibley[a]	64.00	.048	4.00	....	....	....	....	....	....	....
	60.160	.0451	3.760	....	....	....	....	....	....	6.00
Soudan	65.65	.084	4.05	.06	.85	.52	.29	.022	.36	....
	64.803	.0829	3.997	.059	.839	.513	.286	.0217	.355	1.29
Vermilion	64.88	.136	4.24	.06	1.35	.65	.41	.015	.59	....
	64.205	.1345	4.195	.059	1.335	.643	.405	.0148	.583	1.04
Vermilion lump	66.05	.156	2.30	.09	1.06	.64	.42	Trace.	.51	....
	65.600	.1549	2.284	.089	1.052	.635	.417	Trace.	.506	.68
Zenith	65.95	.036	3.30	.108	1.53	.075	....	....	.70	....
	60.845	.0332	3.044	.0996	1.4115	.0691	....	....	.645	7.74

MICHIPICOTEN RANGE.

Ore.	Iron.	Phosphorus.	Silica.	Manganese.	Alumina.	Lime.	Magnesia.	Sulphur.	Loss by ignition.	Moisture.
Helen	58.94	0.112	5.37	0.13	0.91	0.13	0.09	0.063	9.99	....
	55.99	.106	5.10	.12	.86	.12	.08	.0598	9.49	5.00

[a] Expected analysis for the season of 1902.

IRON-ORE INDUSTRY OF THE VARIOUS STATES DURING 1901.

Minnesota.—The active iron-ore mines of Minnesota, all of which are found on the Mesabi and Vermilion ranges, in 1901 contributed 11,109,537 long tons, or 38 per cent of the total for the United States, giving that State undisputed claim to first place. In fact, with the exception of the German Empire and Great Britian, no country in the world has reached so great a total in any year as the State of Minnesota in 1901, and this phenomenal product exceeded by 3,989,175 long tons the production of all the iron-ore mines as reported by the Tenth Census of the United States in 1880, which was 7,120,362 long tons.

All of this ore was of the red hematite variety, in which class Minnesota occupied first place, with 46 per cent of the total for the United States. A single mine, the Fayal, produced 1,681,000 tons, or more iron ore than was probably mined in the whole of the United States in any year prior to 1854, and, considered on the basis of metallic content, this output would have produced as much pig iron as was made in the United States in any year up to 1864.

Michigan.—The Michigan mines of the Marquette, Menominee, and Gogebic ranges contributed in 1901 a total of 9,654,067 long tons, a decrease of 272,660 long tons, or 3 per cent, from the 1900 total of 9,926,727 long tons. Of this amount the greater part, 9,386,707 long tons, was red hematite, in which class the State ranked second; 233,990 long tons were magnetite, in which class it occupied fourth position; and the remainder, 33,370 tons, was brown hematite.

The magnitude of the iron-ore industry of Michigan may be illustrated by the statement that the output of the mines of this State, in both 1900 and 1901, exceeded the total production of iron ore as reported by the Tenth Census, 1880.

Wisconsin.—With the exception of a few brown hematite mines, and a red hematite deposit in Dodge County, all of the iron mines of Wisconsin are in the Gogebic and Menominee ranges. The total output of the State in 1901 was 738,868 long tons, giving it seventh position as a producer. Of this amount, 725,496 long tons were red hematite, giving it fourth rank in producing this class of ore. The remainder, 13,372 tons, was of the brown hematite variety, in which class the State ranked eleventh.

As Minnesota, Michigan, and Wisconsin contain all the mines in the Lake Superior region, they have been discussed together. The other important iron-ore-producing States present the following records:

Alabama.—This State's contribution of iron ore in 1901 was 2,801,732 long tons, giving it third position, with nearly 10 per cent of the total for the United States, being an advance of 42,305 long tons over the 1900 output of 2,759,427 long tons. Of this amount 2,070,422 long tons were red hematite, in which class of ore the State occupied third place, while 731,310 long tons of brown hematite gave it second place as a producer of that variety of ore.

Pennsylvania.—This State, in 1901, regained fourth place as an iron-ore-producer, contributing 1,040,684 long tons, an increase of 163,000 long tons, or 19 per cent, over the 1900 total of 877,684 long tons. All four classes of iron ore were mined, 771,351 long tons being of the magnetite variety, 226,699 long tons brown hematite, 42,381 tons red hematite, and 253 tons carbonate, giving the State respectively first, fifth, ninth, and fourth places.

The greater portion of the iron ore mined in Pennsylvania comes from the Cornwall Ore Hills, which have been described in previous reports.

Virginia and West Virginia.—These two States combined ranked fifth in 1901, mining 925,394 long tons of iron ore, an increase of 3,573 tons, or nearly 4 per cent, over the 1900 total of 921,821 long tons.

Of this amount, 910,214 long tons were brown hematite ore, in which class the States occupied first place; of the remainder, 13,156 tons were red hematite and 2,024 tons magnetite.

Some iron ore was brought into Virginia from the Lake Superior region and also from Kentucky.

Following the policy inaugurated by the Survey of respecting individual reports, West Virginia's small output is combined with that of Virginia.

Tennessee.—This State, owing to an increase of 195,323 long tons, or 33 per cent, from the 1900 total of 594,171 long tons, ranks sixth as a producer of iron ore, the amount mined in 1901 being 789,494 long tons.

The greater part of this augmented output was from the brown hematite mines, which contributed 474,545 long tons, the remaining 314,949 long tons being red hematite.

New York.—In 1901 this State contributed 420,218 long tons of iron ore, a decrease of 21,267 tons, or 5 per cent, from the 1900 total of 441,485 long tons. The greater part, 329,467 long tons, was of the magnetite variety, principally from the Lake Champlain region, in which class of ore the State took third place. Of the remainder, 66,389 tons were red hematite, 23,362 tons brown hematite, and 1,000 tons carbonate.

Colorado.—This State now ranks ninth as a producer of iron ore, with a total of 404,037 long tons. All of the output of 1901 was brown hematite ore, with the exception of 6,978 tons of red hematite. This is a decrease of 3,047 long tons, or 0.8 of 1 per cent, from the 1900 production of 407,084 long tons.

A considerable portion of these Colorado iron ores carry manganese, and some of them small amounts of silver, but not enough to make them valuable on account of the precious metal. The former are used to produce spiegeleisen, and the latter as flux in the smelters. On the other hand, some Colorado iron ores carry enough of the precious metal to make them valuable on that account, and are therefore not included in this report.

New Jersey.—Considerable activity has been exhibited in iron-ore mining in New Jersey, and the 1900 output of 344,247 tons rose to 401,989 long tons in 1901, an advance of 57,742 tons, or 17 per cent.

Several blast furnaces are reported as being projected in this State, and the iron-ore mines may in consequence show a still further increase in 1902.

All of the iron ore mined is of the magnetic variety, in which class the State ranked second.

Georgia and North and South Carolina.—These States together contributed 215,599 long tons of iron ore. The two Carolinas, each producing but a small amount of ore, are grouped with Georgia, so as not to disclose data in regard to individual operations. Of the production of these three States, 153,477 tons were brown hematite, 60,102 tons red hematite, and 2,020 tons magnetite.

Other States.—None of the remaining States, except Wyoming, produced over 100,000 tons of iron ore, the Western States and Territories—Montana, Nevada, New Mexico, Texas, and Wyoming—being grouped together and giving a total of 234,514 long tons. The greater portion of this ore, 157,059 tons, was of the red hematite variety; 72,235 tons were magnetite, and 5,220 tons brown hematite.

Ohio contributed 44,185 long tons, all of the carbonate variety. Missouri produced red and brown hematites. Connecticut, Massachusetts, and Iowa mined brown hematite, Kentucky red hematite, and Maryland brown hematite and carbonate ore.

PROMINENT IRON-ORE PRODUCERS.

During the year ending December 31, 1901, 104 iron-ore operations in the United States each produced over 50,000 tons of iron ore. The total for the 104 mines was 25,534,410 long tons, or 88.4 per cent of the production for the country, but a slight advance over the 1900 percentage of 88.3. It is remarkable that in three years, 1899, 1900, and 1901, the proportion of iron-ore product which has been supplied by the larger operations has borne practically the same relation to the total, showing that these important producers have augmented their output as rapidly as the industry in general has developed. The average per mine, however, advanced from 221,178 tons in 1900 to 245,523 tons in 1901; but the increase from the average production in 1899—242,091 tons—is less marked.

Seventy-eight of the larger mining operations reporting in 1901 produced 22,287,712 long tons of red hematite ore; 15 contributed 1,411,990 long tons of brown hematite; 9 supplied 1,511,146 long tons of magnetite, and 2 mines yielded 323,562 tons of a mixture of red hematite and magnetite.

Of these mining operations, 37 are in Michigan, 30 in Minnesota, 10 in Alabama, 5 in Tennessee, 4 in Wisconsin, 3 each in Colorado, New Jersey, New York, and Virginia, 2 each in Georgia and Pennsylvania, and 1 each in New Mexico and Wyoming.

It will be noticed that 71 of the larger producing mines are credited to the Lake Superior region; and in considering the quantities supplied from the mines in this region, it is well to remember that, owing to climatic conditions affecting transportation, the active exploitation is limited to about seven months. Otherwise the material won must be stocked during the winter and rehandled during the shipping season.

Of the 104 large mining operations, 1 contributed over 1,600,000 tons; 2 others over 1,000,000 tons; 1 between 1,000,000 and 900,000 tons; 1 between 900,000 and 800,000 tons; 2 between 800,000 and

700,000 tons; 5 between 700,000 and 600,000 tons; 2 between 600,000 and 500,000 tons; 5 between 500,000 and 400,000 tons; 5 between 400,000 and 300,000 tons; 16 between 300,000 and 200,000 tons; 26 between 200,000 and 100,000 tons; and 38 between 100,000 and 50,000 tons.

The following table presents a list of the mining operations in the United States which produced over 50,000 tons in 1901, together with the States in which they are located and the amount contributed by each, except for 20 mines whose owners objected to such publication. These have been grouped and placed at the end of the table; but no mine producing over 250,000 tons is included in this group.

Prominent iron mines of the United States, with their production in 1901.

		Long tons.
Fayal, Minn		1,681,000
Red Mountain Group, Ala		1,083,402
Mountain Iron & Rathbun, Minn		1,058,160
Chapin, Mich		927,747
Adams, Minn		810,266
Mahoning No. 3, Minn		766,355
Cornwall, Pa		749,012
Stevenson, Minn		662,929
Chandler, Minn		659,820
Lake Superior, Mich		650,151
East Norrie, Mich	272,083	
Norrie, Mich	186,066	
North Norrie, Mich	182,621	
		640,770
Pioneer, Minn		620,659
Cleveland Hard Ore, Mich	76,815	
Cleveland Lake, Mich	468,333	
		545,148
Aragon, Mich		502,067
Pewabic, Mich		480,216
Lake Angeline, Mich		457,100
Auburn, Minn		433,339
Tilden, Mich		421,316
Biwabik, Minn		410,074
Regent Iron Company, Mich		373,139
Genoa, Minn		353,093
Penn Iron Mining Company, Mich		349,291
Sauntry Alpena, Minn		328,739
Ashland, Mich		299,083
Negaunee, Mich		283,520
Cliffs Shaft, Mich		274,259
Minnesota Iron Company, Minn		257,677
Clark, Minn		255,577
Elba, Minn		244,441
Crystal Falls, Mich		232.294
Atlantic, Wis		217,730
Newport and Bonnie, Mich		213,588
Brown Mining Company, Tenn		213,003
Aurora and Vaughn, Mich		211,126

	Long tons.
Hull, Minn	211,066
Savoy-Sibley, Minn	194,329
Pabst, Mich	185,305
Salisbury, Mich	181,019
Cundy, Mich	177,010
Champion, Mich	172,941
Rust, Minn	170,048
Odanah Iron Company, Wis	167,627
Sparta, Minn	156,426
Duluth, Minn	153,728
Republic and West Republic, Mich	150,621
Hemlock River, Mich	147,276
Montreal, Wis	146,778
Pillsbury, Minn	138,951
Sunrise, Wyo	134,161
Malta, Minn	126,299
Martin Mining Company, Ala	126,907
Riverton Group, Mich	116,982
Richard, N. J	116,612
Orient, Colo	113,475
Burt, Minn	109,458
Great Western, Mich	108,442
Clifton Iron Company, Ala	104,759
Port Henry No. 21, New York	103,723
Bonair, Grey Eagle, Penrose, and Starr, Colo	102,067
Alleghany Iron and Steel Co., Va	100,800
Brotherton, Mich	96,864
Lillie, Mich	93,125
Old Bed, New York	91,827
Sunday Lake, Mich	90,102
Bartow, Ga	88,738
Pinkney Mining Company, Tenn	88,395
Commodore, Minn	82,831
Raimund, Ala	80,000
Chateaugay, N. Y	78,693
Commonwealth, Wis	78,000
Mansfield, Mich	76,419
Gadsden, Ala	73,937
Zenith, Minn	73,511
Princeton, Mich	67,468
Mannie, Tenn	67,306
Quinnesec, Mich	64,900
Clifford, Mich	63,155
Fierro, N. Mex	61,160
Anvil, Mich	57,219
Richmond, Mich	54,181
Tannehill, Ala	54,000
Estelle Mining Co., Ga	53,196
Columbia, Mich	52,948
Chisholm, Minn	52,000
Total	23,122,876
Twenty mines not reported by name	2,411,534
Total	25,534,410

VALUE.

The total value at the mines of the 28,887,479 long tons of iron ores produced in the United States in 1901, as reported to this office, was $49,256,245, or a mean of $1.71 per long ton, an apparent decrease of 71 cents, or 29 per cent, from the 1900 figures of $2.42 per ton. During the year 1901 there was a considerable decline in the prices of iron ores, the basis value for standard Bessemer ore being quoted at $4.25 per long ton, at Cleveland, as against $5.40 per ton in 1900.

The highest average value reported in 1901 was $3.18 per ton in Colorado, where the admixture of manganese and precious metals, as well as the cost of labor, added to the value. The lowest average rate was in Alabama—92 cents per ton.

The production of iron ore in 1901 by States, its total value at the mines, as reported, and also the average value per ton are given in the following table:

Amount and value of iron ores produced in 1901, by States.

States.	Production.	Total value at mines.	Average value per ton.
	Long tons.		
Minnesota	11,109,537	$15,335,513	$1.38
Michigan	9,654,067	21,735,592	2.25
Alabama	2,801,732	2,587,719	.92
Pennsylvania	1,040,684	1,561,620	1.50
Virginia and West Virginia	925,394	1,466,423	1.58
Tennessee	789,494	912,849	1.16
Wisconsin	738,868	1,564 173	2.12
New York	420,218	1,006,231	2.39
Colorado	404,037	1,284,255	3.18
New Jersey	401,989	918,011	2.28
Montana and Nevada New Mexico, Texas, and Wyoming	234,514	367,864	1.57
Georgia and North and South Carolina	215,599	258,227	1.20
Kentucky and Iowa	46,499	48,938	1.05
Ohio	44,185	67,776	1.53
Connecticut and Massachusetts	25,214	73,487	2.91
Maryland	21,218	33,825	1.59
Missouri	14,230	33,742	2.37
Total	28,887,479	49,256,245	1.71

STOCKS.

The total stock of iron ore in the United States, reported as on hand at the mines on December 31, 1901, was 4,239,823 long tons, an increase of 529,873 long tons, or 14 per cent, over the 1900 total of 3,709,950 long tons. The stock represents 15 per cent of the year's production.

The Lake Superior region, comprising the States of Minnesota, Michigan, and Wisconsin, where the ore is mostly sent forward by vessel, and is placed on stock piles during the suspension of navigation, carried a stock of 3,969,726 long tons, or 94 per cent of the total stocks for the United States.

Vermont has mined no iron ore for several years, the stock mentioned having been won in previous years.

The following table gives the stocks of iron ore on hand at the mines December 31, 1901, by States.

Stocks of iron ore on hand at mines December 31, 1901.

States.	Stocks.	States.	Stocks.
	Long tons.		*Long tons.*
Minnesota	1,340,219	Montana and Nevada	29,474
Michigan	2,355,978	New Mexico, Texas, and Wyoming	
Alabama	52,383	Georgia and North and South Carolina	28,836
Pennsylvania	7,132	Kentucky and Iowa	None.
Virginia and West Virginia	19,995	Ohio	20,700
Tennessee	18,000	Connecticut and Massachusetts	3,596
Wisconsin	273,529	Maryland	20
New York	60,665	Missouri	2.315
Colorado	1,713	Vermont	300
New Jersey	24,968	Total	4,239,823

TRANSPORTATION—LAKE SUPERIOR REGION.

Much of the iron ore which is mined in the United States is carried long distances to points of consumption. That of the Lake Superior region reaches plants on the Ohio River, and even competes on the Atlantic seaboard with foreign ores. Large amounts of ore from New Mexico and Wyoming are transported to furnaces in Colorado. The Lake Champlain, New York, magnetites reach Pennsylvania furnaces, and some has been sent to the new plant at Cape Breton, N. S.

The iron-ore deposits of Minnesota, Michigan, and Wisconsin are distant from most of the blast furnaces which they supply. The ore is carried by relatively short rail hauls to shipping ports,[a] and from these by water transportation to the lower lake ports. Of the shipping ports, Two Harbors and Duluth in Minnesota, Superior and Ashland in Wisconsin, and Marquette in Michigan are on Lake Superior; and Escanaba and Gladstone in the State of Michigan are on Lake Michigan. The ore from the Vermilion range is usually shipped from Two Harbors; that from the Mesabi range is divided between Two Harbors, Duluth, and Superior; the Gogebic range ores are shipped from Ashland and Escanaba; and those from the Marquette range are shipped from Marquette and Escanaba. Practically all of the iron ore from the Menominee range goes via Escanaba and Gladstone.

In 1901 the port of Two Harbors continued in the lead, shipping

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[a] See Appendix, p. 72.

5,018,197 long tons of iron ore, or over 1,000,000 tons more than the 1900 total. Escanaba sent forward 4,022,668 long tons, holding second place. Duluth, with a record of 3,437,955 long tons, ranked third. Ashland was fourth, with a total of 2,886,252; and Marquette and Superior were close rivals, the shipments of the former being 2,354,284 long tons, and that of the latter 2,321,077 tons. Gladstone reported 117,089 long tons shipped.

According to the Cleveland Iron Trade Review, the lake shipments of iron ore in 1901 were 20,157,522 long tons, and the amount forwarded by all rail was 431,715 long tons.

The shipments by ports and all rail from 1895 to 1901, inclusive, are as follows, those of last year being the maxima, and the grand total being more than double that of 1896:

Lake shipments of iron ore from 1895 to 1901, inclusive.

Shipping port.	1895.	1896.	1897.	1898.	1899.	1900.	1901.
	Long tons.	*Long tons.*	*Long tons.*	*Long tons.*	*Long tons.*	*Long tons.*	*Long tons.*
Two Harbors	2,118,156	1,813,992	2,651,465	2,693,245	3,973,733	4,007,294	5,018,197
Escanaba	2,860,172	2,321,931	2,302,121	2,803,513	3,720,218	3,436,734	4,022,668
Duluth	1,598,783	1,988,932	2,376,064	2,635,262	3,509,965	3,888,986	3,437,955
Ashland	2,350,219	1,566,236	2,067,637	2,391,088	2,703,447	2,633,687	2,886,252
Marquette	1,079,485	1,564,813	1,945,519	2,245,965	2,733,596	2,661,861	2,354,284
Superior	117,884	167,245	531,825	550,403	878,942	1,522,899	2,321,077
Gladstone	109,211	220,887	341,014	335,956	381,457	418,854	117,089
Total	10,233,910	9,644,036	12,215,645	13,655,432	17,901,358	18,570,315	20,157,522
All-rail shipments.	195,127	290,792	253,993	369,241	350,446	489,078	431,715
Grand total	10,429,037	9,934,828	12,469,638	14,024,673	18,251,804	19,059,393	20,589,237

As the bulk of the iron ore mined in the Lake Superior region is forwarded by vessel to lower lake ports, the increase in the year 1901 over that of the previous year is evident from the statistical report of lake commerce through the canals at Saulte Ste. Marie, Michigan and Ontario, during the season of 1901. This shows that 18,090,618 net tons of iron ore passed through in the season of 1901, an increase of 1,647,050 net tons, or 10 per cent, over the total of 16,443,568 net tons in the season of 1900. The 18,090,618 net tons of iron ore were valued at "The Soo" at $58,794,509, or $3.25 a ton, and the rate per ton for the carriage of this ore averaged 78 cents, a reduction of 27 cents from the average rate of $1.05 in 1900.

The remainder of the ore went to blast furnaces in Illinois, Michigan, and Wisconsin, the bulk of it going to Chicago.

In addition to the iron ore from mines in the United States, shipments are now made from the port of Michipicoten, Ontario, on the northern shore of Lake Superior, the ore being transported to that port by rail from the Helen mine, belonging to the Lake Superior Consolidated Company. Of the 231,209 tons forwarded in 1901, there went to receiving ports in the United States 160,941 tons, and the remainder went to the Canadian furnaces at Hamilton and Midland in the Province of Ontario.

The greater part of the ore sent from the upper lake ports is received at the ports of Lake Erie, at which 17,014,076 long tons (including the Canadian shipment) were delivered in 1901. The difference between the shipments from upper lake ports and the amount received at Lake Erie ports represents the quantity going to the blast furnaces at Chicago, Ill., Milwaukee, Wis., etc., amounting in 1901 to 3,304,387 tons.

Of the receiving ports on Lake Erie, Ashtabula, Cleveland, Conneaut, Fairport, Lorain, Toledo, Huron, and Sandusky are in Ohio; Buffalo and Tonawanda are in New York, and Erie is in Pennsylvania.

The table given below shows the receipts at lower lake ports from 1895 to 1901, inclusive, from which it will be seen that Ashtabula, with a total of 3,981,170 long tons, ranked first, closely followed by Cleveland, with receipts amounting to 3,831,060 long tons; Conneaut had a total of 3,181,019 long tons; then follow in order Buffalo and Tonawanda, Erie, Fairport, Toledo, Lorain, Huron, and Sandusky.

Iron-ore receipts at Lake Erie ports from 1895 to 1901, inclusive.

Port.	1895.	1896.	1897.	1898.	1899.	1900.	1901.
	Long tons.	*Long tons.*	*Long tons.*	*Long tons.*	*Long tons.*	*Long tons.*	*Long tons.*
Ashtabula, Ohio	2,474,791	2,272,822	3,001,914	2,684,563	3,341,526	3,709,486	3,981,170
Cleveland, Ohio	2,312,370	2,313,170	2,456,704	2,645,318	3,222,582	3,376,644	3,831,060
Conneaut, Ohio	244,967	327,623	495,327	1,404,169	2,320,696	2,556,631	3,181,019
Buffalo and Tonawanda, N. Y	719,742	545,101	797,446	1,075,975	1,530,016	1,616,919	1,475,386
Erie, Pa	811,989	847,849	1,311,526	1,092,364	1,309,961	1,240,715	1,379,377
Fairport, Ohio	914,617	941,446	1,008,340	912,879	1,241,013	1,085,554	1,181,776
Toledo, Ohio	260,730	301,794	416,438	414,012	792,348	645,147	798,298
Lorain, Ohio	214,219	191,445	355,188	536,086	1,112,946	1,090,235	721,662
Huron, Ohio	146,442	226,515	198,231	126,755	263,600	321,914	431,311
Sandusky, Ohio	12,361	58,667	79,792	136,200	87,499	154,542	33,017
Total	8,112,228	8,026,432	10,120,906	11,028,321	15,222,187	15,797,787	17,014,076

Although large quantities of the iron ores received at lower lake docks are loaded directly on railroad cars and taken to the blast furnaces, considerable amounts accumulate during the shipping season, which ends about December 1, and these stocks are drawn upon during the winter months. The stock on hand at lower lake ports December 1, 1901, was 5,859,663 long tons, slightly less than the amount, 5,904,670 long tons, reported on December 1, 1900. In 1901 the greater portion of the stocks, 3,147,205 long tons, was at Ashtabula and Cleveland.

Stocks of iron ore at lower lake ports.

Port.	At close of navigation, December 1—						
	1895.	1896.	1897.	1898.	1899.	1900.	1901.
	Long tons.	*Long tons.*	*Long tons.*	*Long tons.*	*Long tons.*	*Long tons.*	*Long tons.*
Ashtabula, Ohio ...	1,301,302	1,441,666	1,835,694	1,732,671	1,902,598	1,811,459	1,769,145
Cleveland, Ohio ...	1,200,792	1,419,311	1,478,355	1,175,970	1,200,806	1,337,445	1,378,060
Fairport, Ohio	605,470	773,905	825,312	719,791	692,147	611,717	710,590
Erie, Pa	335,718	355,222	484,871	439,167	361,335	480,731	470,718
Lorain, Ohio	224,264	231,288	317,509	324,034	337,822	251,838	195,863
Conneaut, Ohio	292,460	275,800	360,895	288,101	468,808	630,514	604,106
Toledo, Ohio	113,132	115,959	194,644	146,568	186,422	242,375	254,196
Huron, Ohio	101,000	200,075	230,029	139,982	164,480	211,377	231,501
Buffalo, N. Y	207,199	82,267	111,660	121,620	192,681	232,100	198,100
Sandusky, Ohio	34,375	59,491	84,786	48,500	23,184	95,111	47,384
Total	4,415,712	4,954,984	5,923,755	5,136,407	5,530,283	5,904,670	5,859,663

Port.	At opening of navigation, May 1—						
	1896.	1897.	1898.	1899.	1900.	1901.	1902.
	Long tons.	*Long tons.*	*Long tons.*	*Long tons.*	*Long tons.*	*Long tons.*	*Long tons.*
Ashtabula, Ohio ...	636,254	926,865	1,031,441	855,691	678,789	1,046,974	924,742
Cleveland, Ohio ...	506,693	979,705	853,776	472,946	386,291	806,119	624,865
Fairport, Ohio	346,847	480,984	501,592	289,417	282,298	306,706	472,325
Erie, Pa	137,826	153,261	236,485	95,626	97,894	225,412	223,972
Lorain, Ohio	118,820	180,605	158,797	168,646	126,212	140,562	96,992
Conneaut, Ohio	112,406	207,034	69,047	6,115	8,649	69,755	152,891
Toledo, Ohio	10,593	66,337	71,726	22,915	52,616	138,457	111,511
Huron, Ohio	55,173	162,292	143,170	82,055	48,412	135,043	129,635
Buffalo, N. Y	16,644	50,477	53,081	72,757	35,195	118,007	73,861
Sandusky, Ohio	8,442	48,937	48,800	7,086	4,300	63,148	37,400
Total	1,949,698	3,256,497	3,167,915	2,073,254	1,720,656	3,050,183	2,848,194

For about five years there has been an interesting legal controversy concerning the freights to be charged for the haul from the Minnesota iron-ore ranges to the docks. The Minnesota State Railway Commission demanded that the railroads connecting the various iron-ore mines in the State with the ore-shipping docks on Lake Superior, which were entirely within the limits of Minnesota, should file their tariffs, and they were then ordered to reduce these 25 per cent, on the ground that the ore transfer was "intrastate" business. The railroad companies claimed that the ore traffic extended from the mines to navigable waters, and that the charges made, including the delivery on shipboard in navigable waters of the United States, were for interstate business, although the tariff was "from mines to dock," and although the rate by ship might be what it would, and the ship might be secured by the ore shipper or owner, indeed might, in many cases, be his own property. The charges were claimed to show an actual through rail and lake rate to the East on ships of joint ownership, in which the rail rate was the same as in all other shipments. The roads admitted that all other traffic was "intrastate," and subject to the orders of the State commission. In November, 1901, the State commission admitted its lack of jurisdiction, thus ending this celebrated case.

CUBA.

The iron-ore deposits which are at present worked in Cuba occur in the southeastern part of the island, along the Caribbean Sea, the principal operations being in the province of Santiago de Cuba. All of these properties are owned and operated by United States companies, and a résumé of the production may be of interest, as practically all of the ore is brought to this country.

The iron ore, a red hematite, occurring partly above ground level in the foothills of the Sierra Maestra Mountains, is transported by rail to the shipping ports of Santiago de Cuba and Daiquiri, from which it is sent forward by vessel. Prior to 1901 three companies had contributed to the output of this island. The Juragua Iron Company, Limited, inaugurated shipments in the year 1884. In 1892 the Sigua Iron Company also commenced operations, sending a few cargoes of ore in that year and the year following, after which mining was discontinued. The Spanish-American Company first mined ore in 1895. All three of these companies have ore beds east of the city of Santiago de Cuba. In the year 1900 exploitations were made to the west of Santiago de Cuba by the Cuban Steel Ore Company, which made its initial shipment in the year 1901. The total amount of iron ore shipped to date from the Cuban mines is 5,050,858 tons, of which all but 70,160 tons were imported into the United States. Other large deposits are reported in northern central Cuba.

The following table, which has been prepared by Mr. Josiah Monroe, shows the annual shipments from the various mines from their opening to the close of 1901:

Shipments of iron ore from mines in the province of Santiago de Cuba.

Year.	Juragua Iron Company, Ltd.	Sigua Iron Company.	Spanish-American Iron Company.	Cuban Steel Ore Company.	Total.
	Long tons.	*Long tons.*	*Long tons.*	*Long tons.*	*Long tons.*
1884	25,295				25,295
1885	80,716				80,716
1886	112,074				112,074
1887	94,240				94,240
1888	206,061				206,061
1889	260,291				260,291
1890	363,842				363,842
1891	264,262				264,262
1892	335,236	6,418			341,654
1893	337,155	14,020			351,175
1894	156,826				156,826
1895	307,503		74,991		382,494

Shipments of iron ore from mines in the province of Santiago de Cuba—Continued.

Year.	Juragua Iron Company, Ltd.	Sigua Iron Company.	Spanish-American Iron Company.	Cuban Steel Ore Company.	Total.
	Long tons.	*Long tons.*	*Long tons.*	*Long tons.*	*Long tons.*
1896	298,885	....	114,110	....	412,995
1897	[a] 248,256	....	[b] 206,029	....	454,285
1898	83,696	....	84,643	....	168,339
1899	161,783	....	215,406	....	377,189
1900	154,871	....	292,001	....	446,872
1901	199,764	....	[c] 334,833	17,651	552,248
Total	3,690,756	20,438	1,322,013	17,651	5,050,858

[a] Of this quantity, 5,932 tons were sent to Pictou, Nova Scotia.
[b] Of this quantity, 51,537 tons were sent to foreign ports.
[c] Of this quantity, 12,691 tons were sent to foreign ports.

Total....... 70,160 tons sent to foreign ports.

IMPORTS.

Through the courtesy of the Bureau of Statistics of the United States Treasury Department, a record of the imports of iron ore into the United States has been obtained, and also data showing the exports in the year 1901. From the tables it will be seen that 966,950 long tons of iron ore, valued at $1,659,273, or $1.72 per ton, were imported into the United States in the year 1901. This is an increase of 69,119 tons, or 7.7 per cent, over the imports (897,831 tons), for the year 1900. The high valuations placed on the iron from the United Kingdom and Germany are probably due to some other chemical component than iron. It should also be borne in mind that the values given represent the price at the point of shipment and not at the receiving ports in the United States.

The following table shows the quantities and values of iron ores imported into the United States from 1896 to 1901, inclusive:

Quantity and value of iron ores imported into the United States from 1896 to 1901, inclusive.

Imported from—	1896.		1897.		1898.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Long tons.		*Long tons.*		*Long tons.*	
Cuba	380,551	$463,570	383,820	$454,709	165,623	$187,721
Spain	121,132	230,879	66,193	167,878	13,335	34,932
French Africa	79,661	163,517	3,504	7,785	....	....
Italy	29,882	85,661	....	....	....	....
Greece	33,750	34,520	....	....	7,200	26,581
Newfoundland and Labrador	20,800	20,965	29,250	29,431	....	....
United Kingdom	8,528	23,155	358	4,091	683	5,385
Colombia	3,150	5,800	....	....	....	....
Portugal	1,101	2,327	3,612	5,831	....	....
Other countries	4,251	6,523	3,233	9,187	367	929
Total	682,806	1,036,917	489,970	678,912	187,208	255,548

Quantity and value of iron ores imported into the United States, etc.—Continued.

Imported from—	1899.		1900.		1901.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Long tons.		*Long tons.*		*Long tons.*	
Cuba	360,813	$449,616	431,265	$537,496	526,583	$705,086
Spain	145,206	339,058	253,694	494,668	180,810	399,364
French Africa	22,233	51,746	20,000	23,536	....	....
Italy	43,363	122,786	18,951	50,945	....	....
Greece	16,765	27,556	23,350	31,685	12,950	42,896
Newfoundland and Labrador	77,970	77,970	140,535	142,685	[a]79,360	79,360
United Kingdom	172	994	397	3,274	490	15,939
Colombia	....	....	3,000	4,854	....	....
British Columbia	....	....	....	....	2,875	4,313
Germany	....	....	145	1,339	400	3,415
Netherlands	....	....	181	854	....	....
Quebec, Ontario, etc	....	....	5,588	10,139	163,383	408,431
Venezuela	....	....	700	1,621	....	....
Sweden and Norway	....	....	25	100	....	....
Other countries	7,560	13,121	....	....	[b]99	469
Total	674,082	1,082,847	897,831	1,303,196	966,950	1,659,273

[a] Newfoundland only.

[b] Of this amount 87 tons, valued at $442, came from Mexico, and 12 tons, valued at $27, from the French West Indies.

As in previous years, Cuba was the largest contributor of imported ore, 526,583 tons being credited to this island. Spain sent 180,810 tons; Quebec, Ontario, etc., sent 163,383 tons; Newfoundland sent 79,360 tons; and small amounts came from various other foreign countries.

The greater portion of this ore was received at the ports of Baltimore, Md., and Philadelphia, Pa., the total for the two being 782,290 tons, or 81 per cent of the whole. The statistics by customs districts, for the years 1898 to 1901, inclusive, are as follows:

Imports of iron ore into the United States, by customs districts.

Port.	1898.		1899.		1900.		1901.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Long tons.		*Long tons.*		*Long tons.*		*Long tons.*	
Baltimore, Md	144,213	$178,905	333,258	$516,888	448,660	$629,507	484,035	$733,071
Delaware	....	....	5,757	7,375	3,331	5,305	....	....
Philadelphia, Pa	42,861	74,226	330,594	549,130	414,064	589,749	298,255	459,698
New York, N. Y	119	1,815	120	703	25,878	63,540	15,865	45,863
Boston, Mass	....	....	75	175	15	71	....	....
Newport News, Va	15	602	....	....	....	....	....	....
Norfolk and Portsmouth, Va	....	....	....	....	....	....	1,850	1,850
Total Atlantic ports	187,208	255,548	669,804	1,074,271	891,948	1,288,172	800,005	1,240,482
Cape Vincent, N. Y	....	....	195	489	....	....	....	....
Buffalo Creek, N. Y	....	....	20	52	1,023	586	53,327	146,596
Cuyahoga, Ohio	....	....	....	....	2,456	6,141	107,810	256,936
Champlain, N. Y	....	....	641	1,555	236	520	63	149
Detroit, Mich	....	....	304	168	52	78	32	49
Genesee, N. Y	....	....	....	....	211	442	....	....
Oswegatchie, N. Y	....	....	125	260	1,131	2,064	2,083	4,485
Vermont	....	....	1,039	2,045	257	454	48	186
Total lake ports	....	....	2,324	4,569	5,366	10,285	163,363	408,401

Imports of iron ore into the United States, by customs districts—Continued.

Port.	1898.		1899.		1900.		1901.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Long tons.		*Long tons.*		*Long tons.*		*Long tons.*	
Saluria, Tex. (total Gulf ports)	....	....	2	$17	....	....	....	....
Puget Sound, Wash	....	....	1,912	3,746	424	$3,781	2,875	$4,313
San Francisco, Cal	....	....	....	....	....	....	550	4,875
San Diego, Cal	....	....	....	....	....	....	87	442
Total Pacific ports	....	....	1,912	3,746	424	3,781	3,512	9,630
Pittsburg, Pa	....	....	40	244	93	958	50	730
Evansville, Ind	....	....	....	....	....	....	20	30
Total interior ports	....	....	40	244	93	958	70	760
Total imports	187,208	$255,548	674,082	1,082,847	897,831	1,303,196	966,950	1,659,273

EXPORTS.

Nearly all of the iron ores exported during the year 1901 was sent to Canadian blast furnaces, which used these ores as a portion of the mixture fed to the furnaces.

The following table shows that 64,703 long tons, valued at $163,465, were exported during the year 1901, and gives the ports from which the various amounts were shipped:

Exports of iron ore from the United States, 1899–1901.

Customs districts.	1899.		1900.		1901.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Long tons.		*Long tons.*		*Long tons.*	
Niagara	17,857	$30,000	....	....	....	....
Superior	11,389	20,012	11,004	$35,213	8,982	$19,754
Duluth	10,534	22,465	38,485	113,962	34,966	83,744
Paso del Norte	703	2,930	....	....	....	....
Saluria	172	823	....	....	....	....
Detroit	7	42	34	120	40	257
Huron	3	15	....	....	....	....
Champlain	....	....	....	....	9,219	24,258
Newport News	....	....	8	128	....	....
Buffalo Creek	....	....	120	300	9,849	31,061
Memphremagog	....	....	1,809	5,033	1,543	4,191
Vermont	....	....	....	....	104	200
Total	40,665	76,287	51,460	154,756	64,703	163,465

The same cordial cooperation of the iron-ore mining interests of the country which has done so much to make former reports valuable is acknowledged as having been offered for 1901, but the numerous changes in ownership and management have made the collection of complete statistics difficult and delayed their presentation.

APPENDIX.

Record of ore docks on the Great Lakes, May 1, 1902.

[Compiled by R. Angst, C. E., Duluth, Minn.]

Railway.	Location.	Dock No.	Number of pockets.	Storage capacity.	Height water to center hinge hole.		Height water to deck of dock.		Width of dock outside to outside of part posts.		Length of spouts.		Length of dock.	Angle of pockets.		Remarks.
				Tons.	′	″	′	″	′	″	′	″	*Feet.*	°	′	
Chicago and Northwestern Railway	Escanaba, Mich	1	184	24,104	28	10	48	6	36	0	21	0	1,104	39	30	No. 2, taken down Feb., 1898.
Do	do	3	226	30,284	31	2	52	8	36	0	27	0	1,356	45	0	
Do	do	4	250	32,750	36	6	59	2	36	0	30	0	1,500	45	0	
Do	do	5	232	43,152	28	6	53	3	36	0	21	8	1,392	40	0	
Do	Ashland, Wis	1	234	36,036	32	10	54	0	46	8	27	0	1,404	39	30	
Do	do	2	234	25,740	36	6	57	8	46	0	27	0	1,404	42	0	
Chicago, Milwaukee and St. Paul Railway	Escanaba, Mich	1	120	25,200	40	2¾	66	6	52	0	27	0	750	45	0	
Do	do	[1]1	120	25,200	40	2¾	66	6	52	0	29	0	750	45	0	
Duluth and Iron Range Railroad	Two Harbors, Minn	1	202	40,400	35	5	59	6	49	0	27	0	1,388	38	42	312 feet, single pockets. 1,076 feet, double pockets.
Do	do	2	208	41,600	33	5	57	6	49	0	27	0	1,280	38	42	
Do	do	3	90	16,200	28	10	52	0	49	0	25	0	572	38	42	
Do	do	4	168	36,960	37	0	62	0	49	0	29	0	1,112	38	42	
Do	do	5	168	33,600	30	0	54	6	49	0	25	0	1,112	38	42	
Duluth, Missabe and Northern Railway	Duluth, Minn	1	384	57,600	30	0	53	0	49	0	27	9	2,336	45	0	
Do	[St. Louis Bay]	2	384	69,120	32	0	57	6	49	0	27	9	2,336	45	0	
Do	do	3	192	40,320	40	7	67	½	59	0	27	9	1,152	45	0	No. 3 dock not in use; taken down in winter of 1899–1900.
Duluth, South Shore and Atlantic Railway	Marquette, Mich	1	270	27,000	25	0	45	0	40	0	20	4	1,700	39	0	
Do	do	3	213	12,780	23	0	37	0	53	6	21	0	1,200	39	0	
Do	do	4	200	28,000	27	9	47	3	36	8	21	1	1,200	39	45	
Lake Superior and Ishpeming Railway	Marquette, Mich., [Presque Isle].	1	200	36,000	30	9	54	0	50	0	24	7	1,232	38	40	
Great Northern Railway	Superior, Wis	1	250	40,500	32	0	57	0	49	8	27	2	1,525	45	0	
Do	[Allouez Bay]	2	350	87,500	40	0	73	0	62	8	32	4	1,500	45	0	
Minneapolis, St. Paul and Sault St. Marie Railway	Gladstone, Mich	1	120	15,000	26	8	47	0	37	0	21	8	768	40	0	
Wisconsin Central Railway	Ashland, Wis	1	314	40,000	31	4	54	6	36	0	27	0	1,908	234-42°30′ 80-50	45	

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[1] Extension.

STATISTICS OF THE AMERICAN IRON TRADE FOR 1901.

By James M. Swank,
General Manager of the American Iron and Steel Association.

GENERAL REVIEW.

The era of unexampled prosperity for the industries of this country which may be said to have been ushered in at the beginning of 1899, when an active demand for iron and steel was suddenly developed, accompanied by rising prices, has continued from that day to this, and at no time has it been more noticeable or more fruitful of good results than when these lines are written, in May, 1902. The whole country has shared in this prosperity.

Special reasons exist for taking a hopeful view of the immediate future of the iron trade. Steadiness in prices, guaranteeing steadiness in demand, is virtually assured by the settled policy of the United States Steel Corporation in resisting the temptation to unduly advance prices. If prices are higher to-day than they were a few months ago they are still within reasonable bounds and represent real values. The use of iron and steel in almost every form increases at even a greater ratio than the increase in our population, while an exceptionally large demand now exists and must for some time continue to exist for iron and steel for steam and trolley railroads and their equipment and for steel for high buildings, warehouses, and other structures, and even for the erection of new iron and steel works. The use of steel in high buildings is sure to call for an increasingly large tonnage from year to year. The same is also true of the use of steel in the manufacture of steel cars. The leading railroads of the country are liberally sharing in the general prosperity, and the great increase in their business calls for track renewals and extensions in greater degree and for new cars and locomotives in greater numbers than ever before, while there is a noticeable increase in the number of new railroad projects that have been successfully started. It may not be generally known that our steam and trolley railroads consume in rails, cars, locomotives, bridges, buildings, and electrical machinery fully one-third of all the iron and steel that we annually make. The building of steel vessels also calls for an increasingly large supply of steel plates and of steel in other forms.

The extraordinary demand for iron and steel that now prevails keeps the existing plants fully employed and their capacity is constantly being increased, so that there is no good reason for believing that we shall be unable to supply any future demand. Much of the recently expressed apprehension that we should be compelled to go abroad this year for iron and steel in large quantities, while justified in part by temporary scarcity of a few leading products, was largely a result of the inability of the railroads last fall and winter to handle promptly the raw materials and the finished products of our iron and steel works, and superficial observers and excited consumers jumped to the conclusion that, because orders for iron and steel could not be filled at sight, the works were unequal to the demands that were made upon them. The truth is that the railroad companies had not expected and therefore had not made provision for so large a demand upon their shipping facilities. Then, again, because of the above-mentioned apprehension; and also because the market has for about six months been tending upward, orders have been given, as is usual on a rising market, far in advance of actual requirements. At the present time all apprehension of a further advance in prices and of a continued scarcity of iron and steel, except perhaps of structural steel, has practically disappeared. The railroads are making deliveries more promptly than they did six months ago. The trouble with structural steel ought to be soon remedied. Our exports of structural steel have been heavy and are now declining, so that the home demand can be more promptly met than it has been. The fashion of putting up tall buildings has grown more rapidly than anybody expected it would, while an unexpectedly large number of steel bridges have been called for—high buildings and steel bridges consuming far more than one-half of all the structural steel that is made.

GENERAL STATISTICAL SUMMARY.

The leading statistics of the iron and steel industries of the United States and of related industries for the year 1901 are presented below, in comprehensive form, together with the statistics of the same industries for 1900—the first year of the twentieth century compared with the last year of the nineteenth century. Detailed statistics for both years will be found in the pages which follow. The figures are marvelous in their magnitude.

In 1901 the United States made 15,878,354 long tons of pig iron, 8,713,302 tons of Bessemer steel ingots, 4,656,309 tons of open-hearth steel, and 13,473,595 tons of steel of all kinds, and rolled in all 12,349,327 tons of finished iron and steel, including rails. There were mined in the same year 28,887,479 long tons of iron ores, and there were shipped 20,589,237 long tons of Lake Superior iron ores, while 12,609,949 short tons of Connellsville coke and 1,279,972 short tons of Pocahontas coke were shipped during the year. The following table gives the production of iron ores, the shipments of Lake Superior iron ores and Connellsville and Pocahontas coke, the production of leading articles of iron and steel, the imports and exports of iron ores and iron and steel, and the miles of new railroad built in 1901 as compared with 1900.

Summary of iron and steel statistics for the United States for 1900 and 1901.

[Long tons, except as stated.]

Article.	1900.	1901.
Total production of iron ores	27,553,161	28,887,479
Shipments of iron ores from Lake Superior	19,059,393	20,589,237
Production of Pennsylvania anthracite coal	51,221,353	60,242,560
Total production of all kinds of coal	240,788,238	261,873,675
Total production of coke ... short tons	20,533,348	21,795,883
Shipments of Connellsville coke ... do	10,166,234	12,609,949
Shipments of Pocahontas Flat Top coke ... do	1,341,444	1,279,972
Production of pig iron, including spiegeleisen and ferromanganese	13,789,242	15,878,354
Production of spiegeleisen and ferromanganese	255,977	291,461
Production of Bessemer steel ingots and castings	6,684,770	8,713,302
Production of open-hearth steel ingots and castings	3,398,135	4,656,309
Production of all kinds of steel	10,188,329	13,473,595
Production of structural shapes, not including plates	815,161	1,013,150
Production of plates and sheets, except nail plate	1,794,528	2,254,425
Production of all rolled iron and steel, except rails	7,101,761	9,474,688
Production of Bessemer steel rails	2,383,654	2,870,816
Production of all kinds of rails	2,385,682	2,874,639
Production of iron and steel wire rods	846,291	1,365,934
Production of all rolled iron and steel, including rails	9,487,443	12,349,327
Production of iron and steel cut nails ... kegs	1,573,494	1,542,240
Production of iron and steel wire nails ... do	7,233,979	9,803,822
Production of tin plates and terne plates	302,665	399,291
Imports of iron ores	897,831	966,950
Exports of iron ores	51,460	64,703
Imports of iron and steel ... value	$20,443,911	$20,394,995
Exports of iron and steel ... do	$129,633,480	$102,534,575
New railroad built ... miles	4,157	5,368

The total production of iron ores in 1901 increased 1,334,318 long tons as compared with the production in 1900. The shipments of Lake Superior iron ores increased 1,529,844 tons and the shipments of Connellsville coke increased 2,443,715 short tons. The production of all kinds of pig iron increased 2,089,112 long tons, and the production of spiegeleisen and ferromanganese increased 35,484 tons. The production of Bessemer steel increased 2,028,532 tons; open-hearth steel, 1,258,174 tons; all kinds of steel, 3,285,266 tons; structural shapes, 197,989 tons; plates and sheets, 459,897 tons; Bessemer steel rails, 487,162 tons; all kinds of rails, 488,957 tons; iron and steel wire rods, 519,643 tons, and all kinds of rolled iron and steel 2,861,884 tons. There was a decrease in the production of iron and steel cut nails in 1901 as compared with the production in 1900 of 31,254 kegs, but an increase in the production of iron and steel wire nails of 2,569,843 kegs. The increase in the production of tin plates and terne plates in 1901 amounted to 96,626 long tons. The increase in the mileage of new railroads was 1,211 miles.

PRODUCTION OF IRON ORES.

Mr. John Birkinbine has compiled for the United States Geological Survey the statistics of the production of iron ores in the United States in 1900 and 1901. The total production in 1901 was 28,887,479 long tons, against a total production in 1900 of 27,553,161 tons, showing an increase of 1,334,318 tons, which increase was most marked in Minnesota, now the leading iron-ore State. The production by States and Territories in 1900 and 1901 is given in the following table:

Production of iron ores in the United States in 1900 and 1901, by States and Territories.

State or Territory.	1900.	1901.
	Long tons.	*Long tons.*
Minnesota	9,834,399	11,109,537
Michigan	9,926,727	9,654,067
Alabama	2,759,247	2,801,732
Pennsylvania	877,684	1,040,684
Virginia and West Virginia	921,821	925,394
Tennessee	594,171	789,494
Wisconsin	746,105	738,868
New York	441,485	420,218
Colorado	407,084	404,037
New Jersey	344,247	401,989
Montana, Nevada, New Mexico, Utah, Texas, and Wyoming	149,158	234,514
Georgia, North Carolina, and South Carolina	336,186	215,599
Kentucky and Iowa	55,057	46,499
Ohio	61,016	44,185
Connecticut and Massachusetts	31,185	25,214
Maryland	26,223	21,218
Missouri	41,366	14,230
Total	27,553,161	28,887,479

IMPORTS OF IRON ORES.

The following table, the data for which were furnished by the Bureau of Statistics of the Treasury Department, gives the quantities and values of iron ores imported into the United States during the calendar years 1899, 1900, and 1901, by customs districts:

Imports of iron ores into the United States from 1899 to 1901, inclusive, by customs districts.

District.	1899.		1900.		1901.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Long tons.		*Long tons.*		*Long tons.*	
Baltimore	333,258	$516,888	448,660	$629,507	484,035	$733,071
New York	120	703	25,878	63,540	15,865	45,863
Philadelphia	330,594	549,130	414,064	589,749	298,255	459,698
Puget Sound	1,912	3,746	....	....	2,875	4,313
Vermont	1,039	2,045	257	454	48	186
All other	7,159	10,335	8,972	19,946	165,872	416,142
Total	674,082	1,082,847	897,831	1,303,196	966,950	1,659,273

In 1901 the imports of iron ores from Cuba amounted to 522,723 long tons, against 419,632 tons in 1900 and 368,759 tons in 1899. Of the total quantity of iron ores imported from Cuba in 1901 the Juragua Iron Company, Limited, sent us 202,180 tons, against 151,961 tons in 1900, while the Spanish-American Iron Company sent us 302,892 tons in 1901, against 292,879 tons in 1900. In 1901 this latter company also shipped 12,849 tons of iron ores to other countries, against 4,200 tons in 1899. It did not ship ore to foreign countries in 1900. The Cuban Steel Ore Company for the first time commenced to ship iron ores in 1901, its shipments to this country in that year amounting to 17,651 tons.

In 1897 the United States imported 135,495 long tons of manganese ores; in 1898, 114,885 tons; in 1899, 188,349 tons; in 1900, 256,252 tons; and in 1901, 165,720 tons.

SHIPMENTS OF LAKE SUPERIOR IRON ORES.

The Iron Trade Review, of Cleveland, gives complete and detailed statistics of the shipments of iron ores from the Lake Superior mines in 1898, 1899, 1900, and 1901, from which the following summary statement of shipments, by ranges and by ports, with all-rail shipments added, has been compiled. The figures include shipments to furnaces in Minnesota, Michigan, and Wisconsin.

Shipments of iron ores from the Lake Superior region from 1898 to 1901, inclusive, by ranges.

Range.	1898.	1899.	1900.	1901.
	Long tons.	*Long tons.*	*Long tons.*	*Long tons.*
Marquette	3,125,039	3,757,010	3,457,522	3,254,680
Menominee	2,522,265	3,301,052	3,261,221	3,605,449
Gogebic	2,498,461	2,795,856	2,875,295	2,938,155
Vermilion	1,265,142	1,771,502	1,655,820	1,786,063
Mesabi	4,613,766	6,626,384	7,809,535	9,004,890
Total	14,024,673	18,251,804	19,059,393	20,589,237

The Marquette range is wholly in Michigan, the Menominee and Gogebic ranges are partly in Michigan and partly in Wisconsin, and the Vermilion and Mesabi ranges are in Minnesota.

Shipments of iron ores from the Lake Superior region from 1898 to 1901, inclusive, by ports.

Port.	1898.	1899.	1900.	1901.
	Long tons.	*Long tons.*	*Long tons.*	*Long tons.*
Escanaba	2,803,513	3,720,218	3,436,734	4,022,668
Marquette	2,245,965	2,733,596	2,661,861	2,354,284
Ashland	2,391,088	2,703,447	2,633,687	2,886,252
Two Harbors	2,693,245	3,973,733	4,007,294	5,018,197
Gladstone	335,956	381,457	418,854	117,089
Superior	550,403	878,942	1,522,899	2,321,077
Duluth	2,635,262	3,509,965	3,888,986	3,437,955
All-rail	369,241	350,446	489,078	431,715
Total	14,024,673	18,251,804	19,059,393	20,589,237

The Lake Superior mines which shipped the largest quantities of iron ores in 1901 were the following: The Norrie and Pabst mines, in the Gogebic range, 859,651 tons; Tilden, in the Gogebic range, 446,670 tons; Ashland, in the Gogebic range, 286,399 tons; Chandler, in the Vermilion range, 627,379 tons; Savoy, in the Vermilion range, 212,008 tons; Minnesota, in the Vermilion range, 208,284 tons; Pioneer, in the Vermilion range, 678,310 tons; Aragon, in the Menominee range, 477,212 tons; Chapin, in the Menominee range, 929,701 tons; Pewabic, in the Menominee range, 507,786 tons; Pittsburg and Lake Angeline, in the Marquette range, 481,574 tons; Lake Superior, in the Marquette range, 635,642 tons; Cleveland-Cliffs, in the Marquette range, 874,465 tons; Mountain Iron, in the Mesabi range, 1,058,160 tons; Fayal, in the Mesabi range, 1,656,973 tons; Mahoning, in the Mesabi range, 765,872 tons; Adams, in the Mesabi range, 829,118 tons, and Stevenson, in the Mesabi range, 666,273 tons.

RECEIPTS OF IRON ORES AT LAKE ERIE PORTS.

The Iron Trade Review annually publishes the statistics of the receipts of Lake Superior iron ores at Cleveland and other ports on Lake Erie, the ports of Buffalo and Erie included, the principal receipts being at Ashtabula and Cleveland; also the quantity left on the docks at the close of navigation. From these statistics the following summary statement from 1888 to 1901 has been compiled.

Receipts of iron ores at Lake Erie ports from 1888 to 1901, inclusive.

Year.	Receipts.	On dock.	Year.	Receipts.	On dock.
	Long tons.	*Long tons.*		*Long tons.*	*Long tons.*
1888	3,783,659	1,848,555	1895	8,112,228	4,415,712
1889	5,856,344	2,607,106	1896	8,026,432	4,954,984
1890	6,874,664	3,893,487	1897	10,120,906	5,923,755
1891	4,939,684	3,508,489	1898	11,028,321	5,136,407
1892	6,660,734	4,149,451	1899	15,222,187	5,530,283
1893	5,333,061	4,070,710	1900	15,797,787	5,904,670
1894	6,350,825	4,834,247	1901	17,014,076	5,859,663

The receipts of Lake Superior iron ores at the ports of Buffalo (including Tonawanda), Erie, and Conneaut in the last seven years are given by the Review as follows:

Receipts of Lake Superior iron ores at Buffalo, Erie, and Conneaut from 1895 to 1901, inclusive.

Port.	1895.	1896.	1897.	1898.	1899.	1900.	1901.
	Long tons.	*Long tons.*	*Long tons.*	*Long tons.*	*Long tons.*	*Long tons.*	*Long tons.*
Buffalo	719,742	545,101	797,446	1,075,975	1,530,016	1,616,919	1,475,386
Erie	811,989	847,849	1,311,526	1,092,364	1,309,961	1,240,715	1,379,377
Conneaut	244,967	327,623	495,327	1,404,169	2,320,696	2,556,631	3,181,019
Total	1,776,698	1,720,573	2,604,299	3,572,508	5,160,673	5,414,265	6,035,782

PRICES OF LAKE SUPERIOR IRON ORES.

The prices at which Lake Superior iron ores has been sold upon season contracts in 1900 and 1901 are given below, per long ton, delivered at lower ports on Lake Erie; also the prices at which sales were made in the spring of 1902 for season delivery. These prices have been furnished by Mr. A. I. Findley, the editor of the Iron Trade Review.

Prices per long ton of Lake Superior iron ores at ports on Lake Erie.

Grade.	1900.	1901.	1902.
Mesabi Bessemer	$4.40 @ $4.90	$2.75 @ $3.00	$3.00 @ $3.40
Mesabi non-Bessemer	4.00 @ 4.25	2.35 @ 2.65	2.75 @ 3.00
Marquette specular No. 1 Bessemer	5.93 @ 6.48	4.66 @ 4.92	4.65 @ 5.00
Marquette specular No. 1 non-Bessemer	5.00	3.65 @ 3.85	3.80 @ 4.00
Chapin	4.96	3.78	3.91
Soft hematites, No. 1 non-Bessemer	4.15 @ 4.25	2.85 @ 3.15	3.00 @ 3.25
Gogebic, Marquette, and Menominee No. 1 Bessemer hematites	5.50 @ 5.75	4.25 @ 4.65	4.25 @ 4.65
Vermilion No. 1 hard non-Bessemer	5.10	4.08	4.07
Chandler No. 1 Bessemer	6.00	4.62	4.50
Marquette extra low-phosphorus Bessemer	6.80 @ 6.90	5.65 @ 5.75	5.40

The base price for 1902 of "old range" Bessemer ores from the Marquette, Menominee, Gogebic, and Vermilion ranges has been fixed at $4.25, the same as in 1901. The base adopted, says Mr. Findley, is a supposititious ore containing 63 per cent of iron, 0.045 per cent of phosphorus, and 10 per cent of moisture. The ore most closely approaching this analysis is the Norrie ore, of the Gogebic range, which for this reason is often spoken of as the base ore. On non-Bessemer ores and on Bessemer and non-Bessemer Mesabi ores the prices for 1902 are generally from 15 to 40 cents per ton above those for 1901.

PRODUCTION AND SHIPMENTS OF COAL AND COKE.

The shipments of anthracite coal from the Pennsylvania mines in 1901 amounted to 53,568,601 long tons, against 45,107,484 tons in 1900, an increase of 8,461,117 tons. These figures are furnished by Mr. W. W. Ruley, the anthracite coal statistician. The production of anthracite coal in Pennsylvania in 1901, including coal mined for colliery consumption, as ascertained by Mr. Edward W. Parker, of the United States Geological Survey, amounted to 60,242,560 long tons, as compared with 51,221,353 tons in 1900. Mr. Parker reports the total production of coal in 1901 as amounting to 261,873,675 long tons, and the total production of coke as amounting to 21,795,883 short tons; for 1900 these quantities were 240,788,238 and 20,533,348 tons, respectively.

The shipments of Cumberland coal from the mines of western Maryland and West Virginia in 1901 amounted to 6,139,329 long tons, against 5,171,916 tons in 1900 and 6,131,461 tons in 1899.

The following information has been furnished by Mr. H. P. Snyder, the editor of the Connellsville Courier: The total production of Connellsville coke in 1901 amounted to 12,609,949 short tons, which was sold at an average price of $1.95 per ton, yielding the producers a revenue of nearly $25,000,000. This production exceeded by 24 per cent that of any previous year, the production in 1900 being 10,166,234 tons, the largest attained prior to 1901. Coke prices were much lower in 1901 than they were during 1900, and while about one-fourth more coke was made the aggregate revenue was less. The value of the coke produced in 1901 was $24,589,400, and the value of the production in 1900 was $27,448,832. The average price of furnace coke for the year 1901 was $1.90, and of foundry coke $2.35, the average price of all the coke being $1.95. The year 1902 opened with the price fixed at $2.25 for furnace coke. The total number of ovens in the Connellsville region increased during the year 1901 from 20,954 to 21,575. During the year 424 ovens were abandoned and 1,045 new ovens were built, the net gain being 621 ovens.

The shipments of Connellsville coke and the average price per short ton from 1880 to 1901 are given in the following table:

Shipments of Connellsville coke, and average price, from 1880 to 1901, inclusive.

Year.	Shipments.	Average price.	Year.	Shipments.	Average price.
	Short tons.			*Short tons.*	
1880	2,205,946	$1.79	1891	4,760,665	$1.87
1881	2,639,002	1.63	1892	6,329,452	1.83
1882	3,043,394	1.47	1893	4,805,623	1.49
1883	3,552,402	1.14	1894	5,454,451	1.00
1884	3,192,105	1.13	1895	8,244,438	1.23
1885	3,096,012	1.22	1896	5,411,602	1.90
1886	4,180,521	1.36	1897	6,915,052	1.65
1887	4,146,989	1.79	1898	8,460,112	1.55
1888	4,955,553	1.19	1899	10,129,764	2.00
1889	5,930,428	1.34	1900	10,166,234	2.70
1890	6,464,156	1.94	1901	12,609,949	1.95

The shipments of Pocahontas Flat Top coke in 1901, the record of which has been furnished by Mr. A. J. Hemphill, secretary of the Norfolk and Western Railway Company, amounted to 1,279,972 short tons, against 1,341,444 tons in 1900 and 1,317,246 tons in 1899.

IMPORTS AND EXPORTS OF COAL AND COKE.

Our exports of anthracite coal in the calendar year 1899 amounted to 1,707,796 long tons, in 1900 to 1,654,610 tons, and in 1901 to 1,993,307 tons. Our exports of bituminous coal in 1899 amounted to 4,044,354 long tons, in 1900 to 6,262,909 tons, and in 1901 to 5,390,086 tons. Our imports of coal, almost wholly bituminous, and chiefly from British North America, amounted to 1,400,522 tons in 1899, to 1,909,376 tons in 1900, and to 1,920,248 tons in 1901. Our exports of coke in 1899 amounted to 280,196 tons, in 1900 to 376,999 tons, and in 1901 to 384,330 tons. Our imports of coke in 1899 amounted to 37,788 tons, in 1900 to 86,565 tons, and in 1901 to 72,820 tons. These figures are from the Bureau of Statistics of the Treasury Department.

AVERAGE MONTHLY PRICES OF IRON AND STEEL.

In the following table are given the average monthly prices of various leading articles of iron and steel in Pennsylvania in 1899, 1900, and 1901, and in five months of 1902. The prices named are per long ton, except for bar iron, which is quoted by the 100 pounds from store at Philadelphia and from mills at Pittsburg, and for steel bars by the 100 pounds at Pittsburg mills.

Average monthly prices of iron and steel in the United States from 1899 to May, 1902, inclusive.

Month.	Old iron T rails, at Philadelphia.	No. 1 foundry pig iron, at Philadelphia.	Gray forge pig iron, at Philadelphia.	Gray forge pig iron, Lake ore, at Pittsburg.	Bessemer pig iron, at Pittsburg.	Steel rails, at mills, in Pennsylvania.	Steel billets, at mills, at Pittsburg.	Best refined bar iron, at Philadelphia.	Best refined bar iron, at mills, at Pittsburg.	Bar steel, at mills, at Pittsburg.
1899.										
January	$13.30	$12.12	$10.75	$9.89	$11.00	$18.50	$17.06	$1.30	$1.12	$1.07
February	14.16	13.25	11.69	10.87	11.69	20.25	18.87	1.45	1.22	1.09
March	16.87	16.00	14.37	13.29	14.77	24.80	24.25	1.70	1.38	1.48
April	17.87	16.50	15.00	14.50	15.06	25.75	25.25	1.75	1.65	1.75
May	18.00	16.60	15.30	15.07	16.32	25.20	27.56	1.90	1.75	1.71
June	18.75	18.62	16.50	15.94	18.70	27.25	31.87	2.00	1.88	2.05
July	20.00	20.37	17.81	17.50	20.45	28.25	33.80	2.30	2.00	2.00
August	21.30	21.70	18.10	18.37	22.37	31.00	36.37	2.40	2.28	2.21
September	23.12	23.50	19.50	20.90	23.85	32.50	41.50	2.50	2.50	2.50
October	26.20	23.70	19.65	21.19	24.50	34.00	41.50	2.50	2.60	2.60
November	27.50	25.00	20.19	21.56	24.69	35.00	39.00	2.50	2.56	2.46
December	27.25	25.00	20.31	21.52	25.00	35.00	36.37	2.50	2.50	2.25
1900.										
January	26.20	25.00	20.35	21.00	24.97	35.00	34.50	2.50	2.50	2.25
February	26.00	24.50	20.19	21.25	25.00	34.20	33.10	2.35	2,50	2.25
March	25.25	23.62	19.19	20.90	24.90	35.00	33.00	2.35	2.50	2.25
April	24.00	23.19	18.50	20.50	24.90	35.00	32.00	2.25	2.45	2.12
May	21.40	22.60	17.80	19.12	24.90	35.00	28.90	2.12	2.34	1.94
June	17.00	20.00	16.50	17.80	21.16	35.00	27.25	1.90	2.20	1.79
July	15.25	17.75	14.56	15.50	17.00	35.00	21.00	1.80	2.00	1.24
August	13.80	17.20	14.45	14.00	16.07	35.00	18.20	1.60	2.00	1.05
September	14.87	17.00	14.12	13.37	14.19	30.25	17.06	1.60	2.00	1.12
October	15.75	16.00	13.55	13.00	13.37	26.00	16.80	1.60	1.81	1.15
November	17.00	16.40	14.12	13.03	13.70	26.00	19.19	1.75	1.73	1.18
December	17.62	16.50	14.50	13.32	13.75	26.00	19.75	1.75	1.75	1.20
1901.										
January	18.00	16.05	14.50	13.25	13.43	26.00	19.75	1,75	1.75	1.20
February	18.25	16.00	14.19	13.56	14.60	26.00	20.31	1.75	1.82	1.27
March	18.37	16.00	14.00	14.62	16.87	26.00	22.87	1.75	1.90	1.44
April	19.50	16.00	14.37	14.56	16.94	26.00	24.00	1.85	1.90	1.50
May	19.50	16.00	14.30	14.62	16.70	28.00	24.00	1.85	1.90	1.50
June	19.12	16.00	14.06	14.15	16.00	28.00	24.37	1.85	1.86	1.50
July	19.00	15.87	13.87	14.00	16.00	28.00	24.00	1.85	1.75	1.52
August	19.00	15.50	13.75	13.87	16.00	28.00	24.20	1.85	1.75	1.50
September	18.50	15.50	13.75	13.81	16.00	28.00	24.87	1.85	1.75	1.50
October	19.90	15.50	13.75	14.10	16.00	28.00	26.70	1.90	1.75	1.52
November	21.25	15.75	13.94	14.69	16.31	28.00	27.00	1.90	1.75	1.60
December	21.50	16.25	14.44	15.12	16.37	28.00	27.50	1.90	1.75	1.60
1902.										
January	21.30	17.55	15.65	16.00	16.70	28.00	27.60	1.95	1.87	1.58
February	21.25	18.37	16.62	16.37	16.94	28.00	29.37	2.00	1.90	1.50
March	23.00	19.44	17.75	17.44	17.37	28.00	31.25	2.05	1.90	1.50
April	25.25	20.37	18.19	18.56	18.75	28.00	31.50	2.10	1.95	1.67
May	25.09	20.50	18.35	19.75	20.75	28.00	32.20	2.15	2.02	1.80

AVERAGE MONTHLY PRICES OF WIRE NAILS AT CHICAGO.

The following table, prepared for this report by Mr. George W. Cope, associate editor of the Iron Age, gives the average monthly base prices of standard sizes of wire nails, per keg of 100 pounds, in carload lots, free on board at Chicago, from 1894 to 1901:

Average monthly prices of wire nails at Chicago from 1894 to 1901, inclusive.

[Kegs of 100 pounds.]

Month.	1894.	1895.	1896.	1897.	1898.	1899.	1900.	1901.
January	$1.17	$0.95	$2.42	$1.50	$1.55	$1.59	$3.53	$2.35
February	1.20	.95	2.42	1.45	1.57	1.73	3.53	2.45
March	1.15	1.00	2.57	1.50	1.55	2.09	3.53	2.45
April	1.00	.95	2.55	1.45	1.47	2.25	3.28	2.45
May	1.07	1.10	2.70	1.42	1.45	2.35	2.53	2.45
June	1.20	1.50	2.70	1.42	1.43	2.60	2.48	2.45
July	1.20	1.95	2.70	1.35	1.36	2.70	2.43	2.45
August	1.15	2.20	2.70	1.37	1.36	2.80	2.43	2.45
September	1.10	2.40	2.70	1.50	1.45	3.10	2.35	2.45
October	1.05	2.40	2.70	1.52	1.47	3.20	2.35	2.42
November	1.05	2.42	2.70	1.50	1.40	3.28	2.35	2.35
December	1.00	2.42	[a] 1.60	1.50	1.37	3.53	2.35	2.25
Average	1.11	1.69	2.51	1.46	1.45	2.60	2.76	2.41

[a] A new nail card was adopted in December, 1896. The average price given for wire nails in December, 1896, on the new card, $1.60 per keg, would be equivalent to $1.10 per keg on the old card, showing a very great decrease in prices.

AVERAGE MONTHLY PRICES OF CUT NAILS AT PHILADELPHIA.

The following table gives the average monthly base prices of cut nails, per keg of 100 pounds, from store at Philadelphia, since 1894, as reported by the Duncannon Iron Company:

Average monthly prices of cut nails at Philadelphia from 1894 to 1901, inclusive.

[Kegs of 100 pounds.]

Month.	1894.	1895.	1896.	1897.	1898.	1899.	1900.	1901.
January	$1.20	$1.00	$2.30	$1.60	$1.35	$1.40	$2.80	$2.25
February	1.20	1.00	2.30	1.55	1.35	1.65	2.80	2.27
March	1.15	.95	2.45	1.55	1.30	1.75	2.80	2.27
April	1.10	.90	2.45	1.50	1.30	1.95	2.62	2.30
May	1.00	1.00	2.45	1.45	1.30	1.95	2.45	2.30
June	1.10	1.50	2.53	1.45	1.30	2.20	2.42	2.30
July	1.10	1.50	2.53	1.40	1.30	2.30	2.30	2.30
August	1.05	1.75	2.53	1.40	1.30	2.35	2.30	2.30
September	1.05	2.20	2.53	1.45	1.30	2.60	2.25	2.35
October	1.00	2.30	2.53	1.45	1.30	2.75	2.28	2.30
November	1.00	2.30	2.00	1.40	1.30	2.80	2.30	2.30
December	.95	2.30	[a] 1.70	1.40	1.30	2.80	2.25	2.30
Average	1.08	1.56	2.36	1.47	1.31	2.21	2.46	2.29

[a] Early in 1893 the base price and schedule of extras of cut nails were changed to correspond with the wire-nail schedule, and in December, 1896, the schedule of extras was again changed to correspond with the new wire-nail schedule.

AVERAGE MONTHLY PRICES OF STEEL BARS AT PITTSBURG.

The following table, compiled from weekly quotations in the American Manufacturer, gives the average monthly prices of steel bars, per 100 pounds, at mills in Pittsburg from 1896 to 1901:

Average monthly prices of steel bars at Pittsburg, Pa., per 100 pounds, from 1896 to 1901, inclusive.

Month.	1896.	1897.	1898.	1899.	1900.	1901.
January	$1.20	$1.07	$1.00	$1.07	$2.25	$1.20
February	1.20	1.05	1.00	1.09	2.25	1.27
March	1.16	1.00	.99	1.48	2.25	1.44
April	1.15	.95	.95	1.75	2.12	1.50
May	1.15	.92	.95	1.71	1.94	1.50
June	1.15	.90	.95	2.05	1.79	1.50
July	1.15	.90	.95	2.00	1.24	1.52
August	1.14	.90	.96	2.21	1.05	1.50
September	1.07	1.00	.99	2.50	1.12	1.50
October	1.05	1.00	1.00	2.60	1.15	1.52
November	1.07	1.00	1.01	2.46	1.18	1.60
December	1.10	1.00	1.00	2.25	1.20	1.60
Average	1.13	0.97	0.98	1.93	1.63	1.47

The lowest quoted price at which steel bars were sold at Pittsburg within the last six years was 90 cents per 100 pounds, this price prevailing in June, July, and August, 1897.

AVERAGE YEARLY PRICES OF IRON AND STEEL.

The following table gives the average yearly prices of leading articles of iron and steel in Pennsylvania, also of wire nails at Chicago, from 1897 to 1901. These prices are obtained by averaging monthly quotations, and these have in turn been averaged from weekly quotations. The prices given are per ton of 2,240 pounds, except for bar iron and steel bars and cut and wire nails, which are quoted by the 100 pounds and in 100-pound kegs, respectively:

Average yearly prices of iron and steel from 1897 to 1901, inclusive.

Article.	1897.	1898.	1899.	1900.	1901.
Old iron T-rails, at Philadelphia	$12.49	$12.39	$20.36	$19.51	$19.32
No. 1 foundry pig iron, at Philadelphia	12.10	11.66	19.36	19.98	15.87
Gray forge pig iron, at Philadelphia	10.48	10.23	16.60	16.49	14.08
Gray forge pig iron, at Pittsburg	9.03	9.18	16.72	16.90	14.20
Bessemer pig iron, at Pittsburg	10.13	10.33	19.03	19.49	15.93
Steel rails, at mills, in Pennsylvania	18.75	17.62	28.12	32.29	27.33
Steel billets, at mills, at Pittsburg	15.08	15.31	31.12	25.06	24.13
Best bar iron, from store, at Philadelphia	1.31	1.28	2.07	1.96	1.84
Best bar iron, at mills, at Pittsburg	1.10	1.07	1.95	2.15	1.80
Steel bars, at mills, at Pittsburg	.97	.98	1.93	1.63	1.47
Cut nails, from store, at Philadelphia	1.47	1.31	2.21	2.46	2.29
Wire nails, base price, at Chicago	1.46	1.45	2.60	2.76	2.41

AVERAGE MONTHLY PRICES OF TIN PLATES.

The following table gives the average wholesale monthly prices per box of "full weight" (108 pounds) imported coke Bessemer tin plates, I. C., 14 by 20, at New York, freight and duty paid, in 1896, 1897, and 1898; also the average wholesale monthly prices of domestic tin plates at New York for the same years:

Average monthly prices of imported and domestic tin plates per box at New York from 1896 to 1898, inclusive.

Month.	Foreign.	Domestic.	Month.	Foreign.	Domestic.	Month.	Foreign.	Domestic.
1896.			1897.			1898.		
January	$3.86	$3.80	January	$3.95	$3.55	January	$4.00	$3.05
February	3.88	3.78	February	3.95	3.35	February	4.00	3.02
March	3.85	3.75	March	3.95	3.32	March	4.00	3.00
April	3.80	3.70	April	3.95	3.39	April	4.00	3.00
May	3.72	3.55	May	3.95	3.34	May	4.00	3.00
June	3.70	3.55	June	3.81	3.30	June	4.00	2.99
July	3.70	3.56	July	3.76	3.17	July	4.00	2.94
August	3.70	3.60	August	3.70	3.20	August	4.00	2.93
September	3.82	3.58	September	3.83	3.18	September	4.00	2.98
October	3.80	3.56	October	4.01	3.11	October	4.00	2.98
November	3.87	3.64	November	3.96	3.10	November	4.00	2.98
December	3.90	3.55	December	4.01	3.09	December	4.00	3.00
Average	3.80	3.63	Average	3.90	3.26	Average	4.00	2.99

In late years foreign tin plates have not been regularly quoted at New York. For this reason foreign prices subsequent to 1898 will not be found in the following table, which gives the average monthly prices of American Bessemer tin plates, I. C., 14 by 20, per box of 100 pounds, at mills in Pennsylvania, from January, 1899, to December, 1901, and which has been compiled for this report by the American Tin Plate Company:

Average monthly prices of tin plates per box of 100 pounds at New York from 1899 to 1901, inclusive.

Month.	Price.	Month.	Price.	Month.	Price.
1899.		1900.		1901.	
January	$3.00	January	$4.65	January	$4.00
February	3.38	February	4.65	February	4.00
March	3.75	March	4.65	March	4.00
April	3.87	April	4.65	April	4.00
May	3.87	May	4.65	May	4.00
June	3.87	June	4.65	June	4.00
July	4.12	July	4.65	July	4.00
August	4.23	August	4.65	August	4.00
September	4.65	September	4.50	September	4.00
October	4.65	October	4.00	October	4.00
November	4.65	November	4.00	November	4.00
December	4.65	December	4.00	December	4.00
Average	4.06	Average	4.47	Average	4.00

PRODUCTION OF PIG IRON.

Twenty States made pig iron in 1901, against 21 in 1899 and 1900. The total production of pig iron in 1901 was 15,878,354 long tons, against 13,789,242 tons in 1900, 13,620,703 tons in 1899, 11,773,934 tons in 1898, and 9,652,680 tons in 1897. The production in 1901 was 2,089,112 tons more than in 1900. The following table gives the half-yearly production in the last six years:

Production of pig iron in the United States from 1896 to 1901, inclusive, by half-year periods.

Period.	1896.	1897.	1898.	1899.	1900.	1901.
	Long tons.	*Long tons.*	*Long tons.*	*Long tons.*	*Long tons.*	*Long tons.*
First half	4,976,236	4,403,476	5,869,703	6,289,167	7,642,569	7,674,613
Second half	3,646,891	5,249,204	5,904,231	7,331,536	6,146,673	8,203,741
Total	8,623,127	9,652,680	11,773,934	13,620,703	13,789,242	15,878,354

The following table gives the half-yearly production of pig iron by States in 1901, arranged according to statistical prominence:

Production of pig iron in the United States in 1901, by States and half-year periods.

State.	First half, 1901.	Second half, 1901.	State.	First half, 1901.	Second half, 1901.
	Long tons.	*Long tons.*		*Long tons.*	*Long tons.*
Pennsylvania	3,549,148	3,794,109	Michigan	93,981	76,781
Ohio	1,598,850	1,727,575	West Virginia	74,630	91,967
Illinois	739,409	857,441	New Jersey	65,524	90,222
Alabama	627,214	597,998	Kentucky	26,361	42,101
Virginia	217,819	230,843	Georgia	15,547	11,786
Tennessee	178,244	158,895	Connecticut	4,621	3,821
Maryland	157,628	145,558	Massachusetts	1,952	1,434
New York	109,317	174,345	Texas	1,320	953
Missouri, Colorado, and Washington	88,775	114,634	Total	7,674,613	8,203,741
Wisconsin	124,273	83,278			

The following table gives the production of pig iron by States in 1900 and 1901, in the order of their prominence in 1901:

Production of pig iron in the United States in 1900 and 1901, by States.

State.	1900.	1901.	State.	1900.	1901.
	Long tons.	*Long tons.*		*Long tons.*	*Long tons.*
Pennsylvania	6,365,935	7,343,257	Michigan	163,712	170,762
Ohio	2,470,911	3,326,425	West Virginia	166,758	166,597
Illinois	1,363,383	1,596,850	New Jersey	170,262	155,746
Alabama	1,184,337	1,225,212	Kentucky	71,562	68,462
Virginia	490,617	418,662	North Carolina and Georgia	28,984	27,333
Tennessee	362,190	337,139	Connecticut	10,233	8,442
Maryland	290,073	303,186	Massachusetts	3,310	3,386
New York	292,827	283,662	Texas	10,150	2,273
Wisconsin and Minnesota	184,794	207,551	Total	13,789,242	15,878,354
Missouri, Colorado, and Washington	159,204	203,409			

Notwithstanding the great increase in the production of pig iron in 1901, eight States made less pig iron in that year than in 1900, as follows: Connecticut, New York, New Jersey, Virginia, West Virginia, Kentucky, Tennessee, and Texas, while Minnesota and North Carolina made no pig iron in 1901. Over 46 per cent of the total increase in production was in Pennsylvania, almost 41 per cent was in Ohio, over 11 per cent was in Illinois, and almost 2 per cent was in Alabama.

PRODUCTION OF PIG IRON ACCORDING TO FUEL USED.

The production of pig iron in 1901, classified according to the fuel used, was as follows, compared with the four preceding years:

Production of pig iron in the United States, by fuels used, from 1897 to 1901, inclusive.

Fuel used.	1897.	1898.	1899.	1900.	1901.
	Long tons.	*Long tons.*	*Long tons.*	*Long tons.*	*Long tons.*
Bituminous, chiefly coke	8,464,692	10,273,911	11,736,385	11,727,712	13,782,386
Mixed anthracite and coke	911,628	1,180,999	1,558,521	1,636,366	1,668,808
Anthracite alone	21,149	22,274	41,031	40,682	43,719
Charcoal	255,211	296,750	284,766	339,874	360,147
Mixed charcoal and coke	...	...	...	44,608	23,294
Total	9,652,680	11,773,934	13,620,703	13,789,242	15,878,354

PRODUCTION OF BESSEMER PIG IRON.

The following table gives the production of Bessemer pig iron, by States, in each year from 1896 to 1901, in long tons. Bessemer pig iron made with charcoal is included.

Production of Bessemer pig iron in the United States from 1896 to 1901, inclusive, by States.

State.	1896.	1897.	1898.	1899.	1900.	1901.
	Long tons.	*Long tons.*	*Long tons.*	*Long tons.*	*Long tons.*	*Long tons.*
Pennsylvania	2,796,884	3,434,930	4,040,965	4,473,493	4,242,397	4,885,877
Ohio	799,061	1,027,897	1,570,535	1,852,965	1,898,663	2,637,091
Illinois	807,511	1,017,991	1,210,124	1,330,169	1,178,241	1,394,430
Maryland	74,628	151,105	186,563	210,670	260,688	297,149
West Virginia	105,275	132,907	192,699	187,858	169,802	166,597
North Carolina	2,151	...	...	...		
Colorado	40,193	6,582	88,701	96,364	118,146	147,216
Missouri	3,198	5,000	30,238			
Kentucky and Tennessee	600	...	...	22,756	13,430	...
Wisconsin	21,957	15,699	14,620	14,519	21,785	39,941
Michigan	3,497	3,473	2,939			
Minnesota	...	...	...			
New Jersey	...	...	...	13,984	40,300	28,492
New York	...	...	...	...		
Total	4,651,955	5,795,584	7,337,384	8,202,778	7,943,452	9,596,793

PRODUCTION OF BASIC PIG IRON.

The production of basic pig iron in 1896 was 336,403 tons; in 1897 it was 556,391 tons; in 1898 it was 785,444 tons; in 1899 it was 985,033 tons; in 1900 it was 1,072,376 tons, and in 1901 it was 1,448,850 tons, all made with coke or mixed anthracite and coke. The production by States since 1898 was as follows:

Production of basic pig iron in the United States from 1898 to 1901, inclusive, by States.

State.	1898.	1899.	1900.	1901.
	Long tons.	*Long tons.*	*Long tons.*	*Long tons.*
New York and New Jersey	645	....	4,929	34,320
Pennsylvania—Allegheny County	378,156	470,848	446,543	568,516
Pennsylvania—other counties	204,547	267,769	344,065	442,744
Maryland, Virginia, Tennessee, and Alabama	151,829	166,093	179,717	301,444
Ohio, Illinois, Wisconsin, and Missouri	47,267	80,332	97,122	101,826
Total	785,444	985,033	1,072,376	1,418,850

Maryland, Tennessee, Illinois, and Wisconsin did not make basic pig iron at any of their furnaces in 1901, as in some other years. The production of basic pig iron made rapid progress in 1901.

PRODUCTION OF SPIEGELEISEN AND FERROMANGANESE.

The production of spiegeleisen and ferromanganese in 1901, included in the total production of pig iron, was 291,461 tons, against 255,977 tons in 1900. The spiegeleisen and ferromanganese produced in 1901 were made in New Jersey, Pennsylvania, Alabama, Illinois, and Colorado.

STOCKS OF UNSOLD PIG IRON.

The following statistics of stocks of unsold pig iron do not include pig iron made by the owners of rolling mills or steel works for their own use, but only pig iron made for sale and not yet sold. The stocks of pig iron which were unsold in the hands of manufacturers or which were under their control at the close of 1901, and were not intended for their own consumption, amounted to 70,647 tons, against 442,370 tons at the close of 1900. The American Pig Iron Storage Warrant Company held in its yards on December 31, 1901, 3,000 long tons of pig iron, of which 2,400 tons were coke and 600 tons were charcoal iron. None of this iron was controlled by the makers. Adding this 3,000 tons to the 70,647 tons of unsold stocks above mentioned makes a total of 73,647 tons of pig iron which were on the market at the close of 1901, against a similar total of 446,020 tons on December 31, 1900.

NUMBER OF FURNACES IN BLAST.

The whole number of furnaces which were in blast at the close of 1901 was 266, against 232 at the close of 1900. The following table shows the number of furnaces in blast at the close of each year since 1896, classified according to the fuel used:

Number of furnaces in blast in the United States from 1896 to 1901, inclusive, by fuels used.

Fuel used.	1896.	1897.	1898.	1899.	1900.	1901.
Bituminous coal and coke	105	146	152	191	155	188
Anthracite and mixed anthracite and coke	32	29	30	68	45	54
Charcoal and mixed charcoal and coke	22	16	20	30	32	24
Total	159	191	202	289	232	266

The number of furnaces out of blast at the close of 1901 was 140. Many of these furnaces were temporarily idle from various causes, others were making much-needed repairs, while still others, on account of being badly located and poorly equipped, were out of blast probably for all time. At the close of 1900 there were 174 furnaces out of blast.

LIMESTONE CONSUMED IN MAKING PIG IRON.

The limestone consumed for fluxing purposes by the blast furnaces of the United States in the production of 15,878,354 tons of pig iron in 1901 amounted to 8,410,578 tons. The average consumption of limestone per ton of all kinds of pig iron produced was 1,186.5 pounds. The consumption by the anthracite and bituminous furnaces was 1,202.7 pounds per ton of pig iron produced, and by the charcoal and mixed charcoal and coke furnaces it was 531.7 pounds. In 1900 the consumption of limestone in producing 13,789,242 tons of pig iron was 7,421,898 tons, or an average consumption of 1,205.6 pounds per ton of pig iron made, the average consumption by the anthracite and bituminous furnaces being 1,222.9 pounds and by the charcoal and mixed charcoal and coke furnaces 603.9 pounds per ton. Oyster shells are also regularly used by one furnace in Maryland for fluxing purposes.

ANNUAL CONSUMPTION OF PIG IRON.

Our consumption of pig iron in the last five years is approximately shown in the following table, the comparatively small quantity of foreign pig iron held in bonded warehouses not being considered. Warrant stocks are included in stocks unsold.

Consumption of pig iron in the United States from 1897 to 1901, inclusive.

Pig iron.	1897.	1898.	1899.	1900.	1901.
	Long tons.	*Long tons.*	*Long tons.*	*Long tons.*	*Long tons.*
Domestic production	9,652,680	11,773,934	13,620,703	13,789,242	15,878,354
Imported	19,212	25,152	40,393	52,565	62,930
Stocks unsold January 1	847,686	874,978	415,333	68,309	446,020
Total supply	10,519,578	12,674,061	14,076,429	13,910,116	16,387,304
Deduct stocks December 31	874,978	415,333	68,309	446,020	73,647
Also exports	262,686	253,057	228,678	286,687	81,211
Approximate consumption	9,381,914	12,005,674	13,779,442	13,177,409	16,232,446
Increase in consumption in 1901 as compared with 1900	....	....	....	....	3,055,037

PER CAPITA CONSUMPTION OF PIG IRON.

The per capita consumption of pig iron in the United States in any given year may be approximately ascertained by adding to our total production of pig iron in that year our imports of pig iron in the same year and deducting our exports of pig iron in that year and by allowing for an increase or decrease of unsold stocks, which will give our total consumption in tons; this total can be reduced to pounds and divided by our total population as ascertained at the nearest census enumeration. There are no statistics of unsold stocks of pig iron prior to 1874.

By taking our population at the three census periods from 1850 to 1870, inclusive, and omitting our exports at each of the corresponding calendar years, which were only nominal, and necessarily omitting all consideration of unsold stocks, the following results for the calendar years 1850, 1860, and 1870 have been obtained. For the calendar years 1880, 1890, and 1900 the results are more precise, as stocks of unsold pig iron at each of these periods were ascertained, while both imports and exports of pig iron are considered, the imports being important in 1880 and 1890 and the exports constituting a considerable factor in 1900. The population factor is for the corresponding census years. For the year 1901 all the elements of consumption above mentioned have been considered, but the average population has necessarily been estimated.

Consumption of pig iron per capita in the United States from 1850 to 1901, inclusive.

Calendar year.	Population. (Census year, except 1901.)	Production.	Imports.	Exports.	Consumption.	Consumption per capita.
		Long tons.	*Long tons.*	*Long tons.*	*Long tons.*	*Pounds.*
1850	23,191,876	563,755	74,874	....	638,629	61.6
1860	31,443,321	821,223	71,498	....	892,721	63.6
1870	38,558,371	1,665,179	153,283	....	1,818,462	105.6
1880	50,189,209	3,835,191	700,864	1,871	3,988,514	178.0
1890	62,979,766	9,202,703	134,955	16,341	8,913,338	318.1
1900	76,303,387	13,789,242	52,565	286,687	13,177,409	386.8
1901 (estimated)	78,303,000	15,878,354	62,930	81,211	16,232,446	464.4

The above exhibits are for pig iron only. If, however, an inquiry were to be made concerning the total consumption of iron per capita—not pig iron only, but also everything that takes the place of pig iron in obtaining finished products, that is, all kinds of cast and wrought scrap and old iron and steel rails, the consumption of which amounted to several million tons per annum in recent years—it would be found that the per capita consumption above given would be increased in the later periods, but would not be materially increased in the earlier periods, when we had no open hearths to require large quantities of old material and when the foundries and rolling mills used only small quantities of cast and wrought scrap respectively.

In the above calculations it has been assumed that pig iron converted into finished forms of iron and steel and exported to other countries, some of it as machinery and in other highly manufactured forms, is really consumed in this country, but technically it is not. On the other hand, the machinery and other finished forms of iron and steel that we have imported have not been considered. The usual method has been followed.

TOTAL PRODUCTION OF PIG IRON, 1897-1901.

The following table gives the total production of pig iron, by States, in the five years from 1897 to 1901, inclusive:

Total production of pig iron from 1897 to 1901, inclusive.

State.	1897.	1898.	1899.	1900.	1901.
	Long tons.	*Long tons.*	*Long tons.*	*Long tons.*	*Long tons.*
Massachusetts	3,284	3,661	2,176	3,310	3,386
Connecticut	8,336	6,336	10,129	10,233	8,442
New York	243,304	228,011	264,346	292,827	283,662
New Jersey	95,696	100,681	127,598	170,262	155,746
Pennsylvania	4,631,634	5,537,832	6,558,878	6,365,935	7,343,257
Maryland	193,702	190,974	234,477	290,073	303,186
Virginia	307,610	283,274	365,491	490,617	448,662
North Carolina	....	....	17,835	28,984	27,333
Georgia	17,092	13,762			
Alabama	947,831	1,033,676	1,083,905	1,184,337	1,225,212
Texas	6,175	5,178	5,803	10,150	2,273
West Virginia	132,907	192,699	187,858	166,758	166,597
Kentucky	35,899	100,724	119,019	71,562	68,462
Tennessee	272,130	263,439	346,166	362,190	337,139
Ohio	1,372,889	1,986,358	2,378,212	2,470,911	3,326,425
Illinois	1,117,239	1,365,898	1,442,012	1,363,383	1,596,850
Michigan	132,578	147,640	134,443	163,712	170,762
Wisconsin	103,909	172,781	203,175	184,794	207,551
Minnesota	....	....			
Missouri	23,883	141,010	138,880	159,204	203,409
Colorado	6,582				
Washington	....				
Total	9,652,680	11,773,934	13,620,703	13,789,242	15,878,354

PRODUCTION OF PIG IRON IN FIRST HALF OF 1902.

The American Iron and Steel Association has received from the manufacturers complete statistics of the production of all kinds of pig iron in the United States in the first half of 1902; also complete statistics of the stocks of pig iron which were on hand and for sale on June 30, 1902.

Total production.—The production of pig iron in the first half of 1902 was 8,808,574 long tons, against 7,674,613 tons in the first half of 1901 and 8,203,741 tons in the second half of 1901. The increase in production in the first half of 1902 over the second half of 1901 was 604,833 tons. The united production of the second half of 1901 and the first half of 1902 amounted to 17,012,315 tons. It is possible that the production of the whole year 1902, notwithstanding the interruption to furnace activity caused by the anthracite strike, may exceed 18,000,000 tons. The production of pig iron by the United States in the first half of 1902 was, in round figures, a million tons greater than the production of either Great Britain or Germany in the whole year 1901, the total production of these countries in that year being respectively 7,761,830 and 7,736,663 long tons.

Classified production.—The production of Bessemer pig iron in the first half of 1902 was 5,105,932 long tons, against 4.582,187 tons in the first half of 1901 and 5,014,606 tons in the second half of 1901. The figures for 1902 include 81,818 tons of low-phosphorus pig iron. In 1901 the production of low-phosphorus pig iron was not separately ascertained, but is included with Bessemer pig iron.

The production of basic pig iron in the first half of 1902 was 1,053,274 long tons, against 645,105 tons in the first half of 1901 and 803,745 tons in the second half of 1901.

The production of charcoal pig iron in the first half of 1902 was 186,098 long tons, against 194,231 tons in the first half of 1901 and 165,916 tons in the second half of 1901. In addition there were produced in Tennessee in the first six months of this year 6.004 tons of pig iron with mixed charcoal and coke.

The production of spiegeleisen and ferromanganese in the first half of 1892 was 118,982 long tons, against 135,920 tons in the first half of 1901 and 155,541 tons in the second half of 1901.

Unsold stocks.—Statistics of unsold stocks do not include pig iron sold and not removed from the furnace bank, or pig iron manufactured by rolling-mill owners for their own use, or pig iron in the hands of consumers. The stocks which were unsold in the hands of manufacturers or their agents on June 30, 1902, amounted to 29,861 tons, against 70,647 tons on December 31, 1901, and 372,560 tons on June 30, 1901. In addition to the 29,861 tons above mentioned, the American Pig Iron Storage Warrant Company had in its yards on June 30, 1902, 1,000 tons of pig iron, of which 800 tons were coke and 200 tons were charcoal pig iron. The manufacturers had parted with the control of this 1,000 tons. The American Iron and Steel Association has never before recorded such small stocks of unsold pig iron as the figures for June 30 represent.

Furnaces in blast.—The whole number of furnaces in blast on June 30, 1902, was 286, against 266 on December 31, 1901, and 259 on June 30, 1901. The number idle on June 30, 1902, was 125.

Furnaces building.—On June 30 there were 28 blast furnaces in course of erection in the United States, of which 24 will use coke for fuel when completed, 2 will use anthracite coal and coke mixed, and 2 will use charcoal. These furnaces are located in the following States: New York, 4 coke; New Jersey, 1 anthracite and coke; Pennsylvania, 11, of which 1 in the Lehigh Valley will use anthracite and coke, and 6 in Allegheny County, 1 in the Shenango Valley, and 3 in other counties in western Pennsylvania will use coke exclusively; Virginia, 1 coke; West Virginia, 1 coke; Tennessee, 1 charcoal; Alabama, 2 coke; Ohio, 2 coke, 1 at Cleveland and 1 at Toledo; Illinois, 1 coke; Michigan, 1 coke and 1 charcoal; and Colorado, 2 coke. A few of these furnaces will be completed and blown in before the close of 1902, but the majority will not be ready for blast until 1903. In addition to the new furnaces enumerated above, several coke furnaces are projected and a number of old furnaces are to be rebuilt during 1902 and 1903.

The anthracite coal strike.—The production of pig iron in 1901 with anthracite and mixed anthracite coal and coke was 1,712,527 tons, or less than one-ninth of the total production, and of the entire anthracite and mixed anthracite coal and coke production of the year only 43,719 tons were made with anthracite alone. The production of pig iron with anthracite and mixed anthracite and coke in the first six months of 1902 amounted to 733,740 tons, against 847,503 tons in the second half of 1901, and the production with anthracite alone amounted to 15,990 tons. These figures, reenforcing those above given for 1901, and in the face of an immense total production of pig iron in the first six months of 1902, show that this country can get along without anthracite coal in its blast furnaces, although it will fare better with it. Coke is now being wholly substituted for mixed anthracite and coke in a number of furnaces which have heretofore used the mixed fuel.

The following anthracite coal or mixed anthracite and coke furnaces were using coke only on June 30, 1902: Wharton Furnaces, Wharton, N. J., 2 stacks; Carbon Furnace, Parryville, Pa., 1 stack; Bethlehem Furnaces, South Bethlehem, Pa., 3 stacks; Crane Furnaces, Catasauqua, Pa., 2 stacks; Durham Furnace, Riegelsville, Pa., 1 stack; Lehigh Steel and Iron Company, Allentown, Pa., 1 stack; Hokendauqua Furnaces, Hokendauqua, Pa., 2 stacks; Keystone Furnace, Easton, Pa., 1 stack; Lock Ridge Furnaces, Alburtis, Pa., 1 stack; Saucon Furnaces, Hellertown, Pa., 1 stack; Keystone Furnaces, Birdsboro, Pa., 1 stack; Keystone Furnace, Reading, Pa., 1 stack; Swede Furnaces, Swedeland, Pa., 2 stacks; Temple Furnace, Temple, Pa., 1 stack; Warwick Furnaces, Pottstown, Pa., 2 stacks; Lebanon Furnaces, Lebanon, Pa., 1 stack; Paxton Furnaces, Harrisburg, Pa., 1 stack; Lochiel Furnace, Harrisburg, Pa., 1 stack; Steelton Furnaces, Steelton, Pa., 4 stacks; Bird Coleman Furnaces, Cornwall, Pa., 1 stack; Colebrook Furnaces, Lebanon, Pa., 1 stack; North Cornwall Furnace, Cornwall, Pa., 1 stack; and Marshall Furnace, Newport, Pa., 1 stack.

PRODUCTION OF BESSEMER STEEL.

The following table gives the production of Bessemer steel ingots and steel castings in the United States in the last five years, by States, including the production by the Clapp-Griffiths, Robert-Bessemer, and Tropenas works.

Production of Bessemer steel in the United States from 1897 to 1901, inclusive, by States.

State.	1897.	1898.	1899.	1900.	1901.
	Long tons.	*Long tons.*	*Long tons.*	*Long tons.*	*Long tons.*
Pennsylvania	3,060,049	3,402,251	3,968,779	3,488,731	4,293,439
Ohio	1,041,541	1,489,115	1,679,237	1,388,121	2,154,846
Illinois	913,774	1,105,040	1,211,216	1,115,571	1,324,217
Other States	429,951	612,608	727,092	692,344	940,800
Total	5,475,315	6,609,017	7,586,354	6,684,770	8,713,302

The total production of Bessemer steel in the United States in 1901 was 8,713,302 long tons, against 6,684,770 tons in 1900, showing an increase in 1901 of 2,028,532 tons, or over 30 per cent. The production of 1901 was by far the largest in our history. Of the production in 1901, 6,764 tons were steel castings, against a similar production in 1900 of 6,467 tons.

No Clapp-Griffiths works were running in 1901 and only two Robert-Bessemer plants were active. Seven Tropenas plants were at work, the same number as in 1900. The Robert-Bessemer and Tropenas plants were employed in the production of steel castings.

PRODUCTION OF OPEN-HEARTH STEEL.

The total production of open-hearth steel in the United States in 1901, including direct steel castings, was 4,656,309 long tons, against 3,398,135 tons in 1900, an increase of 1,258,174 tons, or over 37 per cent. The production of open-hearth steel has more than doubled in the last four years, having increased from 2,230,292 tons in 1898 to the figures above given for 1901. The following table gives the production of open-hearth steel ingots and castings, by States, since 1896:

Production of open-hearth steel in the United States from 1896 to 1901, inclusive, by States.

State.	1896.	1897.	1898.	1899.	1900.	1901.
	Long tons.	*Long tons.*	*Long tons.*	*Long tons.*	*Long tons.*	*Long tons.*
New England	48,055	51,402	47,381	57,124	74,522	170,876
New York and New Jersey	32,120	39,521	47,957	61,461	67,361	82,985
Pennsylvania	1,009,608	1,271,751	1,817,521	2,393,811	2,699,502	3,594,763
Ohio	64,691	78,357	79,886	117,458	130,191	184,943
Illinois	101,832	120,609	183,103	246,183	285,551	398,522
Other States	42,394	47,031	51,444	71,279	141,008	224,220
Total	1,298,700	1,608,671	2,230,292	2,947,316	3,398,135	4,656,309

The open-hearth steel made in 1901 was produced by 90 works in 14 States—Massachusetts, Connecticut, Rhode Island, New York, New Jersey, Pennsylvania, Delaware, Tennessee, Alabama, Ohio, Indiana, Illinois, Wisconsin, and Missouri. In 1900 94 works and 17 States made open-hearth steel. Neither Maryland, Kentucky, Michigan, nor Minnesota produced open-hearth steel in 1901, although all four States were producers in 1900. Rhode Island made open-hearth steel for the first time in 1901. New England more than doubled its production in 1901 over 1900.

In 1900 the production of open-hearth steel by the basic process amounted to 2,545,091 tons and by the acid process to 853,044 tons. In 1901 3,618,993 tons were made by the basic process and 1,037,316 tons by the acid process, as follows:

Production of open-hearth steel in the United States in 1901, by processes.

State.	Basic open-hearth steel.	Acid open-hearth steel.	Total.
	Long tons.	*Long tons.*	*Long tons.*
New England	87,529	83,347	170,876
New York and New Jersey	46,805	36,180	82,985
Pennsylvania	2,840,230	754,533	3,594,763
Ohio	120,146	64,797	184,943
Illinois	353,395	45,127	398,522
Other States	170,888	53,332	224,220
Total	3,618,993	1,037,316	4,656,309

In 1900 our open-hearth steel production for the first time exceeded that of Great Britain, which amounted to 3,156,050 tons. Great Britain's production in 1900 was the largest in her history down to that year. Her production in 1901 was 3,297,791 tons.

PRODUCTION OF OPEN-HEARTH STEEL CASTINGS.

The total production of open-hearth steel castings in 1901, included above, amounted to 301,622 long tons, of which 94,941 tons were made by the basic process and 206,681 tons by the acid process. In 1900 the production of open-hearth steel castings amounted to 177,491 tons, of which 42,644 tons were made by the basic process and 134,847 tons by the acid process. The following table gives the production of open-hearth steel castings by the acid and basic processes in 1901, by States:

Production of open-hearth steel castings in the United States in 1901, by processes.

State.	Acid castings.	Basic castings.	Total.
	Long tons.	*Long tons.*	*Long tons.*
New England, New York, and New Jersey	33,165	3,989	37,154
Pennsylvania	101,631	3,855	108,486
Ohio, Indiana, Illinois, and other States	68,885	87,097	155,982
Total	206,681	94,941	301,622

PRODUCTION OF CRUCIBLE AND MISCELLANEOUS STEEL.

The production of crucible steel in the United States in 1901 amounted to 98,513 long tons, against 100,562 tons in 1900, 101,213 tons in 1899, 89,747 tons in 1898, 69,959 tons in 1897, 60,689 tons in 1896, 67,666 tons in 1895, 51,702 tons in 1894, and 63,613 tons in 1893. Nine States made crucible steel in 1901—Massachusetts, Connecticut, New York, New Jersey, Pennsylvania, Tennessee, Ohio, Illinois, and Wisconsin. The direct castings produced in 1901 by the crucible process, included above, amounted to 3,927 tons. Pennsylvania made about three-fourths of the country's total crucible steel production in 1901.

The production of steel in the United States in 1901 by various minor processes amounted to 5,471 long tons, almost all of which was in the form of direct castings, against 4,862 tons in 1900.

PRODUCTION OF ALL KINDS OF STEEL.

The production of all kinds of steel ingots and castings in the United States in 1901 is given in the following table, in long tons. Of the total production 317,570 tons were direct steel castings. The increase in the production of all kinds of steel in 1901, as compared with 1900, was 3,285,266 tons, or 32.2 per cent.

Production of steel in the United States in 1901, by States and kinds.

State.	Bessemer.	Open-hearth.	Crucible and miscellaneous.	Total, ingots and castings.
	Long tons.	*Long tons.*	*Long tons.*	*Long tons.*
Massachusetts, Rhode Island, and Connecticut		170,876	2,237	173,113
New York and New Jersey		82,985	23,763	106,748
Pennsylvania	4,293,439	3,594,763	71,800	7,963,002
Delaware, Maryland, West Virginia, Kentucky, Tennessee, and Alabama	736,547	179,548	75	916,170
Ohio	2,154,846	184,943	2,508	2,340,021
Indiana and Illinois	1,324,217	430,012		1,756,505
Michigan, Wisconsin, Minnesota, Missouri, Colorado, and California	204,253	13,182	601	218,036
Total	8,713,302	4,656,309	103,984	13,473,595

In 1900 the production of all kinds of steel was as follows: Bessemer steel, 6,684,770 long tons; open-hearth steel, 3,398,135 tons; crucible steel, 100,562 tons; all other steel, 4,862 tons; total, 10,188,329 tons, against 10,639,857 tons in 1899. Included in the figures for 1900 are 192,803 tons of direct castings.

PRODUCTION OF ALL KINDS OF STEEL CASTINGS.

The following table gives, by States, the production of Bessemer, open-hearth, crucible, and other steel castings in 1901, in long tons:

Production of steel castings in the United States in 1901, by States and kinds.

State.	Bessemer.	Open-hearth.	Crucible and miscellaneous.	Total.
	Long tons.	*Long tons.*	*Long tons.*	*Long tons.*
Massachusetts, Connecticut, New York, and New Jersey		37,154	6,086	43,240
Pennsylvania	715	108,486	1,101	110,302
West Virginia, Tennessee, Alabama, and Ohio	693	27,473	200	28,366
Indiana, Illinois, and Michigan	3,641	115,327	1,196	120,164
Wisconsin, Minnesota, Missouri, Colorado, and California	1,715	13,182	601	15,498
Total	6,764	301,622	9,181	317,570

Of the total production in 1901, Pennsylvania made almost 35 per cent, Illinois over 32 per cent, Ohio over 8 per cent, Massachusetts over 5 per cent, and no other State over 4.7 per cent.

PRODUCTION OF ALL KINDS OF RAILS.

The production of Bessemer steel rails by the producers of Bessemer steel ingots in 1901 was 2,836,273 long tons, against a similar production of 2,361,921 tons in 1900 and 2,240,767 tons in 1899. The maximum production of Bessemer steel rails by the producers of Bessemer steel ingots was reached in 1901. The year of next largest production was 1900, which was closely followed by its predecessor, 1899. In 1887, the fourth year of largest production, 2,044,819 tons were made. The following table shows the production, by States, of Bessemer steel rails by the producers of Bessemer steel ingots in the last five years:

Production of all kinds of steel rails in the United States from 1897 to 1901, inclusive.

State.	1897.	1898.	1899.	1900.	1901.
	Long tons.	*Long tons.*	*Long tons.*	*Long tons.*	*Long tons.*
Pennsylvania	1,024,386	1,052,771	1,224,807	1,195,255	1,406,008
Other States	590,013	902,656	1,015,960	1,166,666	1,430,265
Total	1,614,399	1,955,427	2,240,767	2,361,921	2,836,273

To the above total for 1901 must be added 34,543 tons of Bessemer rails made in the same year from purchased blooms and from rerolled and renewed Bessemer steel rails, making a grand total for 1901 of 2,870,816 tons of Bessemer steel rails. Eighteen plants rolled or renewed Bessemer steel rails in 1901, of which 6 were located in Pennsylvania, 2 in Maryland, 5 in Ohio, 2 in Illinois, 1 in Wisconsin, 1 in Colorado, and 1 in Wyoming.

In 1901 the United States made much the largest quantity of open-hearth steel rails it has made in recent years—in all, 2,093 tons. These rails were rolled in Pennsylvania, Alabama, and Ohio, Alabama producing almost two-thirds of the total quantity made. The production of iron rails in 1901 was 1,730 tons, all made in Tennessee, Alabama, and Colorado. Adding the open-hearth and iron rails to the Bessemer steel rails above mentioned gives a grand total of 2,874,639 tons of rails produced in 1901, which is much the largest production ever attained in one year.

WEIGHT OF ALL KINDS OF RAILS.

The following table gives the production of all kinds of rails in 1901 according to the weight of the rails per yard. Street rails are included in the total production of rails.

Production of steel rails in the United States in 1901, by kinds and weights.

Kind of rail.	Under 45 pounds.	45 pounds and less than 85.	85 pounds and over.	Total.
	Long tons.	*Long tons.*	*Long tons.*	*Long tons.*
Bessemer steel rails	152,110	2,224,884	493,822	2,870,816
Open-hearth steel rails	1,566	527	....	2,093
Iron rails	1,730	....	....	1,730
Total	155,406	2,225,411	493,822	2,874,639

The total production of all kinds of rails in 1900 was 2,385,682 tons, of which 157,531 tons weighed less than 45 pounds to the yard, 1,626,093 tons weighed 45 and less than 85 pounds, and 602,058 tons weighed 85 pounds or over. The tonnage of street rails can no longer be separated from the total rail tonnage.

PRODUCTION OF STRUCTURAL SHAPES.

Our statistics of iron and steel structural shapes embrace the production of beams, beam girders, zee bars, tees, channels, angles, and other structural forms, but they do not include plate girders made from plates. Plates are provided for under other classifications, and in the general statistics of plates are included all plates cut to specifications. Nearly all the structural shapes and plates used for structural purposes are made of steel. The total production of strictly structural shapes in 1900 was 815,161 tons, and in 1901 it was 1,013,150 tons. The production of structural shapes in 1900 and 1901, by States, was as follows:

Production of structural shapes in the United States in 1900 and 1901, by States.

State.	1900.	1901.	State.	1900.	1901.
	Long tons.	*Long tons.*		*Long tons.*	*Long tons.*
New York and New Jersey.	34,242	51,002	Colorado and California..	8,863	5,700
Pennsylvania	759,712	925,940	Total	815,161	1,013,150
Alabama and Ohio........	12,344	30,508			

The increased production of structural shapes in 1901 as compared with 1900 amounted to 197,989 long tons, or over 24 per cent. Pennsylvania made over 91 per cent of the total production in 1901. New Jersey over 3 per cent, and Ohio almost 3 per cent. No other State made 1.5 per cent of the total production.

PRODUCTION OF WIRE RODS.

The production of iron and steel wire rods in the United States in 1901 amounted to 1,365,934 long tons, against 846,291 tons in 1900, 1,036,398 tons in 1899, and 1,071,683 tons in 1898, showing an increase of 519,643 tons, or over 61 per cent, in 1901 as compared with 1900. Of the total production in 1901, 1,365,459 tons were steel and 475 tons were iron rods. The following table gives the production, by States, in the last three years:

Production of wire rods in the United States from 1899 to 1901, inclusive.

State.	1899.	1900.	1901.
	Long tons.	*Long tons.*	*Long tons.*
Massachusetts, Connecticut, Rhode Island, New York, and New Jersey	139,945	134,502	176,101
Pennsylvania	319,058	240,533	386,037
Kentucky, Alabama, and Ohio	312,620	244,731	422,679
Indiana and Illinois	264,775	226,525	381,117
Total	1,036,398	846,291	1,365,934

Pennsylvania made the largest quantity of wire rods in 1901, with Illinois a close second, Ohio third, and Massachusetts fourth. Seven other States—Rhode Island, Connecticut, New York, New Jersey, Kentucky, Alabama, and Indiana—also rolled wire rods in 1901. With the exception of Rhode Island, which first rolled rods in 1901, all the States named produced rods in 1900 also.

PRODUCTION OF WIRE NAILS.

The production of wire nails in the United States in 1901 amounted to 9,803,822 kegs of 100 pounds, as compared with 7,233,979 kegs in 1900, an increase of 2,569,843 kegs, or over 35 per cent. In 1899 the production amounted to 7,618,130 kegs, in 1898 to 7,418,475 kegs, in 1897 to 8,997,245 kegs, in 1896 to 4,719,860 kegs, and in 1895 to 5,841,403 kegs. The wire nails made in 1901 were manufactured by 61 works, as compared with 56 in 1900. The production in 1901 was greatly in excess of that of any other year, exceeding by 806,577 kegs that of 1897, the year of next largest production. The following table gives the production of wire nails in 1899, 1900, and 1901, in kegs of 100 pounds:

Production of wire nails in the United States from 1899 to 1901, inclusive, by States.

[Kegs of 100 pounds.]

State.	1899.	1900.	1901.
Massachusetts, Rhode Island, and Connecticut	176,877	212,584	71,553
New York	49,603	63,466	136,118
Pennsylvania	2,905,211	2,158,399	3,118,508
Maryland, West Virginia, Kentucky, Alabama, and Ohio	2,154,823	2,516,391	3,633,894
Indiana and Illinois	2,184,662	2,195,672	2,716,748
Michigan, Wisconsin, Kansas, Washington, and California	146,954	87,467	127,001
Total	7,618,130	7,233,979	9,803,822

PRODUCTION OF CUT NAILS.

The following statistics of the production of iron and steel cut nails and cut spikes do not embrace railroad and other spikes made from bar iron, wire nails of any size, or machine-made horseshoe nails. Spikes cut from plates are included with cut nails.

The total production of cut nails in 1901 was 1,542,240 kegs of 100 pounds each, against 1,573,494 kegs in 1900, a decrease of 31,254 kegs, or a little less than 2 per cent. In 1886 the maximum production of 8,160,973 kegs was reached. In 1901 the production of wire nails exceeded that of cut nails by 8,261,582 kegs, in 1900 by 5,660,485 kegs, in 1899 by 5,713,790 kegs, in 1898 by 5,846,254 kegs, and in 1897 by 6,890,446 kegs.

Eleven States made cut nails in 1901, one more than in 1900. The following table shows the production of iron and steel cut nails by States from 1896 to 1901, in kegs of 100 pounds. The wire-nail production is added to the table. The decreased production of cut nails in Ohio in 1901 as compared with previous years is due to the fact that two of its leading producers recently installed wire-nail machines and were engaged in the manufacture of both kinds of nails last year, their cut-nail production in 1901 being much smaller than in former years.

Production of cut nails in the United States from 1896 to 1901, inclusive, by States.

[Kegs of 100 pounds.]

State.	1896.	1897.	1898.	1899.	1900.	1901.
Pennsylvania	646,011	1,057,964	768,171	920,133	777,611	833,469
Ohio	264,272	411,396	392,003	386,215	261,216	123,788
West Virginia and Indiana	286,210	290,203	184,942	178,006	168,469	150,222
Massachusetts and New Jersey	137,005	142,021	127,706	149,700	155,968	179,474
Illinois	91,145	34,000	87,399	255,286	193,230	240,657
Maryland, Virginia, and Kentucky	167,227	164,465				
Missouri, Wisconsin, Colorado, Wyoming, and California	24,000	6,750	12,000	15,000	17,000	14,630
Total cut nails	1,615,870	2,106,799	1,572,221	1,904,340	1,573,494	1,542,240
Total wire nails	4,719,860	8,997,245	7,418,475	7,618,130	7,233,979	9,803,822
Grand total	6,335,730	11,104,044	8,990,696	9,522,470	8,807,473	11,346,062

PRODUCTION OF PLATES AND SHEETS.

The production of plate and sheet iron and steel in the United States in 1901, excluding nail plate, amounted to 2,254,425 long tons, against 1,794,528 tons in 1900, an increase of 459,897 tons, or over 25 per cent. Skelp iron and steel are not included in the statistics of plates and sheets, but are classed with other rolled products. The following table gives the production, by States, of all kinds of plates and sheets in 1901:

Production of iron and steel plates and sheets in the United States in 1901, by States.

State.	1901.	State.	1901.
	Long tons.		*Long tons.*
New England	416	Ohio	294,266
New York and New Jersey	6,512	Indiana, Illinois, Michigan, Missouri, and Colorado	271,816
Pennsylvania	1,572,500		
Delaware and Maryland	29,481	Total	2,254,425
West Virginia	31,928		
Kentucky and Alabama	47,503		

The production of "black plates for tinning" alone in 1901, which is included above, was 385,026 long tons. Of this total, Pennsylvania made over 50 per cent. New Jersey, Maryland, West Virginia, Ohio, Indiana, Michigan, and Missouri also made black plates for tinning in 1901.

PRODUCTION OF TIN PLATES.

The duty on tin plates and terne plates provided for in the tariff act of 1890 went into effect on July 1, 1891. From that date until the close of the fiscal year ending on June 30, 1897, the statistics of our production of tin plates and terne plates were regularly collected for the Treasury Department by Col. Ira Ayer, special agent. For the second half of 1897 and the year 1898 they were collected by the Metal Worker, of New York; and for 1899, 1900, and 1901 they have been compiled by the American Iron and Steel Association. From the data thus obtained the following table of our production of tin plates and terne plates in the calendar years 1891 to 1901 has been prepared. The production of tin dipping plants is included.

Production of tin plates in the United States from 1891 to 1901, inclusive.

Calendar year.	Quantity.	Calendar year.	Quantity.
	Long tons.		*Long tons.*
1891 (last six months)	999	1897	256,598
1892	18,803	1898	326,915
1893	55,182	1899	360,875
1894	74,260	1900	302,665
1895	113,666	1901	399,291
1896	160,362		

PRODUCTION OF ALL ROLLED IRON AND STEEL.

The phrase rolled iron and steel, as here used, includes all iron and steel rolled into finished forms, as follows: (1) All sizes of iron and steel rails; (2) plate and sheet iron and steel; (3) iron and steel plates for cut nails and cut spikes; (4) wire rods; (5) iron and steel structural shapes; (6) bar, bolt, hoop, skelp, rolled axles, fish plates, rolled armor plate, and other rolled products. Forged armor plate, hammered axles, and other forgings are not included, nor such intermediate forms as muck bars, billets, and tin plate and sheet bars.

The production of all iron and steel rolled into finished forms in the United States in 1901 was 12,349,327 long tons, against 9,487,443 tons in 1900, an increase of 2,861,884 tons, or over 30 per cent. Twenty-six States rolled either iron or steel or both iron and steel in 1901. The following table gives the total production, by States, of rolled iron and steel in 1901, in long tons:

Production of rolled iron and steel in the United States in 1901, by States.

State.	Quantity.	State.	Quantity.
	Long tons.		*Long tons.*
Maine and Massachusetts	165,100	Alabama	109,391
Rhode Island and Connecticut	48,043	Ohio	1,566,996
New York	182,948	Indiana	399,707
New Jersey	143,367	Illinois	1,442,165
Pennsylvania	6,962,668	Michigan	103,063
Delaware	58,242	Wisconsin	181,867
Maryland	301,446	Missouri	37,182
Virginia	29,026	Colorado and Wyoming	197,980
West Virginia	201,264	Washington, Oregon, and California	32,152
Kentucky	156,506	Total	12,349,327
Tennessee and Georgia	30,214		

TOTAL PRODUCTION OF ROLLED IRON AND STEEL.

The total production of all kinds of iron and steel rolled into finished forms in the United States from 1887 to 1901 is given below:

Production of rolled iron and steel in the United States from 1887 to 1901, inclusive.

Year.	Iron and steel rails.	Bars, hoops, skelp, shapes, etc.	Wire rods.	Plates and sheets, except nail plate.	Cut nails.	Total.
	Long tons.	*Long tons.*	*Long tons.*	*Long tons.*	*Long tons.*	*Long tons.*
1887	2,139,640	2,184,279	....	603,355	308,432	5,235,706
1888	1,403,700	2,034,162	279,769	609,827	289,891	4,617,349
1889	1,522,204	2,374,968	363,851	716,496	259,409	5,236,928
1890	1,885,307	2,618,660	457,099	809,981	251,828	6,022,875
1891	1,307,176	2,644,941	536,607	678,927	223,312	5,390,963
1892	1,551,844	3,033,439	627,829	751,460	201,242	6,165,814
1893	1,136,458	2,491,497	537,272	674,345	136,113	4,975,685
1894	1,021,772	2,155,875	673,402	682,900	108,262	4,642,211
1895	1,306,135	3,005,765	791,130	991,459	95,085	6,189,574
1896	1,122,010	2,731,932	623,986	965,776	72,137	5,515,841
1897	1,647,892	3,081,760	970,736	1,207,286	94,054	7,001,728
1898	1,981,241	3,941,957	1,071,683	1,448,301	70,188	8,513,370
1899	2,272,700	4,996,801	1,036,398	1,903,505	85,015	10,294,419
1900	2,385,682	4,390,697	846,291	1,794,528	70,245	9,487,443
1901	2,874,639	5,785,479	1,365,934	2,254,425	68,850	12,349,327

Pennsylvania made over 56 per cent of the total production of rolled iron and steel in 1901, Ohio over 12 per cent, Illinois over 11 per cent, and Indiana over 3 per cent. No other State produced 2.5 per cent. Minnesota and Kansas, both of which States have rolling mills, did not produce any rolled iron or steel in 1901, but Minnesota made a small quantity of direct steel castings.

PRODUCTION OF IRON BLOOMS AND BILLETS.

The blooms and billets made in forges directly from the ore in 1901 amounted to 2,310 long tons, against 4,292 tons in 1900, 3,142 tons in 1899, 1,767 tons in 1898, 1,455 tons in 1897, and 1,346 tons in 1896. All the ore blooms produced in the last four years were made by the Chateaugay Ore and Iron Company, of Plattsburg, N.Y., at its Standish Iron Works.

The iron blooms produced in forges from pig and scrap iron in 1901, which were for sale and not intended for the consumption of the makers, amounted to 8,237 long tons, against 8,655 tons in 1900, 9,932 tons in 1899, 6,345 tons in 1898, and 7,159 tons in 1897. All the pig and scrap blooms made in forges from 1895 to 1901, and intended to be for sale, were made in Pennsylvania and Maryland.

IMPORTS AND EXPORTS OF IRON AND STEEL.

A marked change has taken place in our foreign trade in iron and steel since this subject was prominently referred to in the reports for 1899 and 1900. In 1899 and immediately preceding years the iron and steel industries of Europe were exceptionally prosperous; there was an active demand and prices were high. In the years just prior to 1899 the prices of iron and steel in the United States were lower than they had ever been. Under these conditions we naturally found opportunities to dispose of our surplus iron and steel products in neutral markets and even in the home markets of our European competitors. But these conditions have now materially changed; the European demand and European prices have declined and the home demand upon our own iron and steel works has greatly increased, while our prices have advanced; hence there is sharper competition in neutral and all foreign markets and increased foreign competition in our own markets. The details of our iron and steel imports and exports since the turn of the tide will bear examination.

The total value of our iron and steel exports in the calendar year 1901 amounted to $102,534,575, against $129,633,480 in 1900, showing a loss of $27,098,905 in one year. Our imports of iron and steel in 1901 amounted to $20,394,995, against $20,443,911 in 1900 and $15,800,579 in 1899, showing a considerable increase since 1899, which will be further emphasized during the present year, as shown below. The decline in the value of our exports in 1901 was largely due to the very great shrinkage in our exports of pig iron, which amounted in that year to 81,211 tons, against 286,687 tons in 1900.

Our exports of iron and steel in the first four months of the calendar year 1902 included 12,982 long tons of pig iron, against 39,068 tons in the same period of 1901; 525 tons of steel billets, ingots, blooms, etc., against 25,749 tons in the same period of 1901; and

33,293 tons of iron and steel rails, against 126,281 tons in the same period of 1901. Here is a very great decline in the exports of a few leading iron and steel products. Our imports of iron and steel in the first four months of 1902 included 52,441 tons of pig iron, against 8,646 tons in the same period of 1901; 26,105 tons of steel billets, etc., including structural steel, against 2,353 tons in the same period of 1901; and 2,640 tons of iron and steel rails, against 492 tons in the same period of 1901. Here are large increases in iron and steel imports.

IMPORTS.

The following table, compiled from the reports of the Bureau of Statistics of the Treasury Department, gives the quantities of various leading articles of iron and steel and of iron ores and manganese ores imported into the United States in the calendar years 1899, 1900, and 1901:

Imports of iron and steel and iron ores and manganese ores into the United States from 1899 to 1901, inclusive.

Imports.	1899.	1900.	1901.
	Long tons.	*Long tons.*	*Long tons.*
Pig iron, spiegeleisen, and ferromanganese	40,393	52,565	62,930
Scrap iron and scrap steel	10,925	34,431	20,130
Bar iron	19,791	19,685	20,804
Iron and steel rails	2,134	1,448	1,905
Hoop, band, or scroll iron and steel	663	165	2,974
Steel ingots, billets, structural steel, etc	12,601	12,709	8,151
Sheet, plate, and taggers' iron and steel	7,043	5,143	5,626
Tin plates	58,915	60,386	77,395
Wire rods, iron or steel	17,964	21,092	16,804
Wire, and articles made from	2,363	1,848	4,129
Anvils	240	223	251
Chains	188	260	198
Total iron and steel	173,220	209,955	221,297
Iron ores	674,082	897,831	966,950
Manganese ores	188,349	256,252	165,720

Our total imports of iron and steel, including machinery, cutlery, firearms, etc., for which weights are not obtainable, amounted in foreign value to $20,394,995 in the calendar year 1901, against $20,443,911 in 1900 and $15,800,579 in 1899, showing a decrease in 1901, as compared with 1900, of $48,916, and as compared with 1899 of $4,594,416.

Of the pig iron imported in recent years a large part was spiegeleisen and ferromanganese, which pay duty as pig iron.

EXPORTS.

The following table, also compiled from the reports of the Bureau of Statistics, gives our exports of leading articles of iron and steel and of iron ores in the calendar years 1899, 1900, and 1901:

Exports of leading articles of iron and steel and of iron ores from 1899 to 1901, inclusive.

Article.	1899.	1900.	1901.
	Long tons.	*Long tons.*	*Long tons.*
Ferromanganese	13	32	81,211
All other pig iron	228,665	286,655	
Scrap and old, for remanufacture	76,663	49,328	14,199
Bar iron	10,898	13,299	17,708
Band, hoop, or scroll iron	2,869	2,976	1,561
Bars or rods of steel, not wire rods	30,429	81,366	27,397
Steel wire rods	16,992	10,652	8,161
Billets, ingots, and blooms	25,487	107,385	28,614
Cut nails and spikes	9,974	11,163	9,302
Wire nails	33,517	27,404	18,773
All other nails, including tacks	2,076	1,812	1,896
Iron plates and sheets	6,196	9,331	6,905
Steel plates and sheets	50,635	45,534	23,923
Iron rails	6,442	5,374	901
Steel rails	271,272	356,245	318,055
Structural iron and steel	54,244	67,714	54,005
Wire	116,317	78,014	88,238
Total iron and steel	942,689	1,154,284	700,852
Iron ores	40,665	51,460	64,703
Locomotives ....number	484	436	418

Our total exports of iron and steel, which include locomotives, car wheels, machinery, castings, hardware, saws and tools, sewing machines, stoves, printing presses, boilers, etc., amounted in the calendar year 1901 to $102,534,575, against $129,633,480 in 1900, $105,690,047 in 1899, $82,771,550 in 1898, and $62,737,250 in 1897. Our exports of iron and steel more than doubled in value from 1897 to 1900, but there was a shrinkage in 1901 as compared with 1900 of $27,098,905, or over 20 per cent.

EXPORTS OF AGRICULTURAL IMPLEMENTS.

Our exports of agricultural implements, which are not included above, amounted in the calendar year 1901 to $16,714,308, against $15,979,909 in 1900, $13,594,524 in 1899, $9,073,384 in 1898, and $5,302,807 in 1897. These exports increased in value more than threefold in the five years from 1897 to 1901.

IRON AND STEEL SHIPBUILDING.

In the fiscal year ending June 30, 1900, there were built in the United States 90 steel vessels, and in the fiscal year 1901 there were built 119 steel vessels and 1 iron vessel. The gross tonnage of the vessels built in the fiscal year 1900 was 196,851 tons, and the gross tonnage of the vessels built in the fiscal year 1901 was 262,699 tons. In the first nine months of the fiscal year 1902, ending March 31, there were built 84 steel vessels, with a gross tonnage of 151,340 tons. Vessels for the United States Navy are not included in the figures here given, which have been furnished by the Hon. Eugene T. Chamberlain, Commissioner of Navigation of the Treasury Department.

Of the 84 vessels built in the nine months of the fiscal year 1902, above referred to, 29 were built at ports on the Great Lakes, their tonnage amounting to 84,838 long tons out of a total tonnage of 151,340 tons.

STATISTICS OF THE CANADIAN IRON TRADE FOR 1901.

In the last report attention was called to the recent rapid development of the iron and steel industries of Canada. This development still continues. Down to 1901 it was confined chiefly to the manufacture of pig iron, the increase in the production of pig iron in 1901 over 1900 amounting to 158,886 long tons, or over 184 per cent. But in 1901 a great impetus was given to the manufacture in Canada of Bessemer and open-hearth steel and of rolled iron and steel products, but the new plants then built or undertaken were not actively at work until 1902. New blast furnaces were also built or undertaken in 1901.

Canada has just practically completed and put in operation two large steel plants—one at Sydney, Cape Breton, Nova Scotia, for the manufacture of open-hearth steel, and one at Sault Ste. Marie, in the Algoma district, in the Province of Ontario, for the manufacture of Bessemer steel. The former is owned by the Dominion Iron and Steel Company, Limited, and the latter by the Algoma Steel Company, Limited. The open-hearth plant made its first steel on December 31, 1901. It is equipped with ten 50-long-ton Campbell tilting furnaces (3 acid and 7 basic), and has an annual capacity of 425,000 long tons of ingots, which are rolled into blooms, billets, and slabs, of which 400,000 tons can be annually produced. The Bessemer steel plant is equipped with two 6-long-ton acid converters, which have an annual capacity of 200,000 tons of ingots. Steel was first made on February 18, 1902, Canadian pig iron being used. The company's rolling mill is expected to turn out annually about 180,000 tons of steel rails and structural shapes. Its first rail was rolled on May 5, 1902.

The open-hearth plant at Sydney has connected with it four modern blast furnaces, their combined annual capacity amounting to 500,000 long tons of pig iron. All these furnaces have been blown in. The Bessemer plant at Sault Ste. Marie is to have four blast furnaces, two of which the company expects to put in blast in the near future and two in the coming fall. The estimated annual capacity of these four furnaces is 380,000 long tons. Two of the furnaces will use coke and two will use charcoal.

In addition to the plants named above, the Cramp Steel Company, Limited, is now erecting works at Collingwood, Ontario, for the production of Bessemer and open-hearth steel and rolled iron and steel. The Bessemer department is to be equipped with two 5-long-ton acid converters, with an annual capacity of 100,000 tons of ingots, and the open-hearth department with two 15-long-ton furnaces (one acid and one basic), with an annual capacity of 30,000 tons of ingots. The rolling mill will be equipped for the manufacture of rails, structural shapes, bar iron, shafting, etc., for which it will have an annual capacity of about 200,000 tons. The erection of two coke blast furnaces, each with a daily capacity of 250 tons of pig iron, is contemplated by this company.

The Nova Scotia Steel and Coal Company, Limited, of New Glasgow, Nova Scotia, broke ground in April, 1902, at Sydney, Cape Breton, for the foundations for 2 coke furnaces. The company now operates a blast furnace at Ferrona and a rolling mill and open-hearth steel plant at New Glasgow, both in Nova Scotia.

PRODUCTION OF PIG IRON.

The production of pig iron in Canada, as ascertained from the manufacturers by the American Iron and Steel Association, amounted in the calendar year 1901 to 244,976 long tons, against 86,090 tons in 1900, an increase of 158,886 tons, or over 184 per cent. Of the production in 1901, 228,893 tons were made with coke and 16,083 tons with charcoal. The production of Bessemer pig iron, included above, amounted to 29,577 tons. Neither spiegeleisen nor ferromanganese was made. The production of pig iron in Canada from 1894 to 1901 is given in the following table. The statistics of the Association do not go back of 1894.

Production of pig iron in Canada from 1894 to 1901, inclusive.

Year.	Quantity.	Year.	Quantity.
	Long tons.		*Long tons.*
1894	44,791	1898	68,755
1895	37,829	1899	94,077
1896	60,030	1900	86,090
1897	53,796	1901	244,976

On December 31, 1901, the unsold stocks of pig iron in Canada amounted to 59,472 long tons, as compared with 12,465 tons at the close of 1900 and 9,932 tons at the close of 1899. Of the unsold pig iron on hand on December 31, 1901, 54,563 tons were coke pig iron and 4,909 tons were charcoal pig iron.

PRODUCTION OF STEEL.

The total production of steel in Canada in 1901 was 26,084 tons, against 23,577 tons in 1900, an increase of 2,507 tons. Both Bessemer and open-hearth steel ingots and castings were made in 1900 and 1901. Of the total production of open-hearth steel in 1901 less than one-fourth was made by the acid process. The following table gives the production of all kinds of steel ingots and castings in Canada from 1894 to 1901:

Production of steel ingots and castings in Canada from 1894 to 1901, inclusive.

Year.	Quantity.	Year.	Quantity.
	Long tons.		*Long tons.*
1894	25,685	1898	21,540
1895	17,000	1899	22,000
1896	16,000	1900	23,577
1897	18,400	1901	26,084

PRODUCTION OF ROLLED IRON AND STEEL.

The production of open-hearth steel rails in 1901 amounted to 891 long tons, against 700 tons in 1900; structural shapes, 4,388 tons, against 4,674 tons in 1900; cut nails made by rolling mills and steel works having cut-nail factories connected with their plants, 126,891 kegs of 100 pounds, against 117,186 kegs in 1900; plates and sheets, 2,857 tons, against 2,100 tons in 1900; all other rolled products, excluding such intermediate forms as muck and scrap bars, blooms, billets, sheet bars, etc., 98,206 tons, against 87,984 tons in 1900. Changing the cut-nail production to long tons, the total quantity of all kinds of iron and steel rolled into finished products in 1901 amounted to 112,007 tons, against 100,690 tons in 1900.

The following table gives the production of all kinds of rolled iron and steel in finished forms in Canada from 1895 to 1901:

Production of rolled iron and steel in Canada from 1895 to 1901, inclusive.

Year.	Quantity.	Year.	Quantity.
	Long tons.		*Long tons.*
1895	66,402	1899	110,642
1896	75,043	1900	100,690
1897	77,021	1901	112,007
1898	90,303		

SUMMARY OF CANADIAN IRON AND STEEL WORKS IN 1901.

On December 31, 1901, there were 14 completed furnaces in Canada and 4 other furnaces were in course of erection—2 charcoal and 2 coke. In addition 4 furnaces were projected. Of the completed furnaces 7 were in blast and 7 were idle. During 1899–1901 4 furnaces were erected by the Dominion Iron and Steel Company at Sydney, 3 of which were blown in in 1901. The fourth furnace was put in blast in January, 1902. Of the 14 completed furnaces 9 were equipped to use coke, 4 to use charcoal, and 1 to use charcoal and coke. The annual capacity of the 18 built or building furnaces on December 31, 1901, was 1,090,300 tons, of which 958,000 tons are credited to 11 coke furnaces.

On December 31, 1901, there were 18 completed rolling mills and steel works in Canada and 2 were building. Of these, 1 was equipped for the manufacture of steel in a special Bessemer converter, 1 to make Tropenas steel, and 2 standard Bessemer steel plants were building; and 4 plants were equipped for the manufacture of open-hearth steel, and 1 open-hearth steel plant was building. The annual capacity of the built and building plants was 838,400 tons of steel and 981,900 tons of rolled products.

CANADIAN BOUNTIES ON IRON AND STEEL.

As has been heretofore explained, the recent rapid development of the iron and steel industries of Canada has been greatly promoted by the action of the Dominion Parliament in enacting the bounty act of June 29, 1897. But the bounty system had previously been in force in Canada. In 1883 the Dominion Parliament authorized the payment of a bounty of $1.50 a ton on all pig iron manufactured in Canada. This bounty was continued until July 1, 1889, when the rate was made $1 a ton. A further change was made on July 1, 1892, when the rate was increased to $2 a ton until July 1, 1897, and in 1894 additional legislation provided for the payment of a bounty of $2 a ton on puddled bars and on steel billets.

The act of 1897, most fruitful of all, provided for the payment of $3 per ton "on steel ingots manufactured from ingredients of which not less than 50 per cent of the weight thereof consists of pig iron made in Canada;" $3 per ton "on puddled iron bars manufactured from pig iron made in Canada;" $3 per ton "on pig iron on the proportion produced from Canadian ore;" and $2 per ton "on pig iron on the proportion produced from foreign ore." These bounties have been extended to June 30, 1907, provided, however, that they shall be annually reduced after April 23, 1902, as follows: From that date to June 30, 1903, 90 per cent shall be paid; from July 1, 1903, to June 30, 1904, 75 per cent; from July 1, 1904, to June 30, 1905, 55 per cent; from July 1, 1905, to June 30, 1906, 35 per cent; from July 1, 1906, to June 30, 1907, 20 per cent.

Down to June 30, 1901, there had been paid in iron and steel bounties under the foregoing acts a total of $2,168,435. In addition to these payments the Province of Ontario has paid since 1894 a bounty of $1 a ton on all pig iron made in the province from iron ore mined in Ontario. To October 31, 1901, there had been paid under this legislation $59,741.

The following details of the payments of bounty by the Dominion Government from 1884 to 1901 are copied from the Statistical Year Book of Canada for 1901, for a copy of which the writer is indebted to the courtesy of the Hon. George Johnson, statistician of the Dominion Department of Agriculture.

In the following table are the amounts which have been paid under the Federal parliamentary authorization:

Bounties paid by the Canadian Government on iron and steel from 1884 to 1901, inclusive.

Fiscal year.	Total amount.	Amount per ton.	Fiscal year.	Total amount.	Amount per ton.
1881	$44,090	$1.50	1893	$93,896	$2.00
1885	38,655	1.50	1894	125,044	2.00
1886	39,270	1.50	1895	63,384	2.00
1887	59,576	1.50	1896	104,105	2.00
1888	33,314	1.50	1897	66,509	2.00
1889	37,234	1.50	1898	165,654	(a)
1890	25,697	1.00	1899	187,954	(a)
1891	20,153	1.00	1900	238,296	(a)
1892	30,294	1.00	1901	351,259	(a)

[a] Three dollars per ton on pig iron made from Canadian ore and $2 per ton on pig iron made from foreign ore.

In the following table will be found a statement of the quantities of steel ingots, steel billets, and puddled bars manufactured in Canada and of the bounties paid thereon from 1896 to 1901, inclusive:

Quantities of steel and amount of bounty paid on steel in Canada from 1896 to 1901, inclusive.

Year ending June 30—	Steel ingots.		Steel billets.		Puddled bars.	
	Quantity.	Bounty paid.	Quantity.	Bounty paid.	Quantity.	Bounty paid.
	Short tons.		*Short tons.*		*Short tons.*	
1896	....	....	29,749	$59,498	2,806	$5,611
1897	....	....	8,683	17,366	1,509	3,019
1898	18,137	$54,412	[a] 4,912	[a] 13,042	2,615	7,706
1899	24,881	74,644	(b)	(b)	5,837	17,511
1900	21,453	64,360	(b)	(b)	3,374	10,121
1901	33,352	100,058	(b)	(b)	5,568	16,703

[a] Manufactured in 1896–97 and paid for in 1897–98.
[b] No bounty paid on steel billets after June 30, 1897.

WORLD'S IRON TRADE IN LATE YEARS.

In his last report the writer presented as complete a record as was then possible of the world's production of iron and steel and iron ores and coal in 1899 and 1900, the last two years of the nineteenth century. In the accompanying tables is given a more complete and, it is believed, an authentic record for both these years for all countries for which statistics are obtainable. The countries which do not appear in the tables are collectively small producers of iron and steel, iron ores, and coal, and some of them are not producers at all. The only noteworthy omission from these tables is the production of iron ores by Russia. Its production of pig iron, steel, and coal is, however, given.

Making due allowance for the production of such minor producing countries as are not named in the tables, and also for Russia's probable production of iron ores, and counting the metric ton as the virtual equivalent of the long ton, the writer has obtained, in round figures, the following approximately accurate totals for the whole world of the products mentioned for 1900, the last year of the nineteenth century: Iron ores, 90,000,000 tons; coal, 760,000,000 tons; pig iron, 40,400,000 tons; steel, 27,430,000 tons. Of the total production of iron ores in 1900, the United States produced over 30 per cent; of coal, over 31 per cent; of pig iron, over 34 per cent, and of steel, over 37 per cent. It is almost unnecessary to add that the contribution of the United States to the world's production of iron ores, coal, pig iron, and steel in 1901 was much larger than it was in 1900, its production of iron ores in 1901 having increased 1,334,318 long tons, its production of pig iron, 2,089,112 tons, and its production of steel, 3,285,266 tons. Its production of coal in 1901 was 261,873,675 long tons.

Statistics for other countries than the United States for 1901 are very incomplete, and no effort is here made to compile complete results for that year.

World's production of iron ores, coal, pig iron, and steel in 1899 and 1900.

UNITED STATES.

	1899.	1900.
	Long tons.	*Long tons.*
Production of coal	226,553,564	240,788,238
Production of iron ores	24,683,173	27,553,161
Production of pig iron	13,620,703	13,789,242
Production of Bessemer steel	7,586,354	6,684,770
Production of open-hearth steel	2,947,316	3,398,135
Production of crucible and other steel	106,187	105,424
Total production of steel	10,639,857	10,188,329
Production of Bessemer steel rails	2,270,585	2,383,654

World's production of iron ores, coal, pig iron, and steel in 1899 and 1900—Continued.

GREAT BRITAIN.

	1899.	1900.
	Long tons.	*Long tons.*
Production of coal	220,094,781	225,181,300
Exports of coal	41,180,332	44,089,197
Production of iron ores	14,461,330	14,028,208
Imports of iron ores	7,054,578	6,297,963
Production of pig iron	9,421,435	8,959,691
Production of Bessemer steel	1,825,074	1,745,004
Production of open-hearth steel	3,030,251	3,156,050
Total production of steel	5,000,000	5,050,000
Production of Bessemer steel rails	838,148	759,844

CANADA AND OTHER COUNTRIES.

Production of—	*Long tons.*	*Long tons.*
Coal in Canada	4,397,367	5,007,737
Coke in Canada	90,018	140,298
Iron ores in Canada	66,622	108,929
Pig iron in Canada	94,077	86,090
Steel in Canada	22,000	23,577
Shipments of iron ores from Cuba	373,921	444,840
Production of—		
Coal in Chile	[a]241,995	[a]325,042
Coal in India	5,093,260	6,118,692
Iron ores in India	61,532	63,073
Pig iron in India	19,631	....
Coal in New South Wales	4,597,028	5,507,497
Coal in New Zealand	975,234	1,093,990
Coal in other Australasia	857,262	870,148
Coal in Cape Colony	186,299	198,451
Coal in Natal	328,693	241,330
Coal in Japan	[a]6,716,831	[a]7,429,457
Pig iron in Japan	[a]23,066	[a]21,299
Coal in Turkey in Asia	[a]270,000	[a]270,000
Coal in Sumatra	[a]181,743	[a]196,206
Iron ores in Algeria	[a]550,941	[a]601,788

[a] Metric tons.

CONTINENTAL COUNTRIES.

	1899.	1900.
Production of—	*Metric tons.*	*Metric tons.*
Coal and lignite in France	32,862,712	33,404,298
Iron ores in France	4,985,702	5,447,694
Pig iron in France	2,578,401	2,714,298
Bessemer steel in France	879,181	919,283
Open-hearth steel in France	619,845	645,881
Miscellaneous steel in France	31,806	30,377
All kinds of steel in France	1,530,832	1,595,541
Coal and lignite in Germany	135,844,419	149,788,256
Iron ores in Germany and Luxemburg	17,989,635	18,964,294
Pig iron in Germany and Luxemburg	8,143,132	8,520,541
Steel in Germany and Luxemburg	[a]6,328,666	[a]6,361,650

[a] These figures are official and are for finished and partly finished steel.

World's production of iron ores, coal, pig iron, and steel in 1899 and 1900—Continued.

CONTINENTAL COUNTRIES—Continued.

	1899.	1900.
	Metric tons.	*Metric tons.*
Coal in Belgium	22,072,068	23,462,317
Iron ores in Belgium	201,445	247,890
Pig iron in Belgium	1,024,576	1,018,507
Steel ingots in Belgium	731,249	654,827
Coal in Spain	2,565,437	2,514,545
Iron ores in Spain	9,397,733	8,675,749
Pig iron in Spain	295,840	294,118
Bessemer and open-hearth steel ingots in Spain	117,650	150,634
Coal in Sweden	239,344	252,320
Iron ores in Sweden	2,435,200	2,609,500
Pig iron in Sweden	497,727	526,868
All kinds of steel in Sweden	273,454	300,536
Coal and lignite in Italy	388,534	480,859
Iron ores in Italy	236,549	247,278
Pig iron in Italy	19,218	23,990
Steel in Italy	108,501	115,887
Iron ores in Greece	628,512	523,800
Coal and lignite in Austria-Hungary	38,738,372	39,029,729
Iron ores in Austria-Hungary	3,293,004	3,528,441
Pig iron in Austria-Hungary	1,467,663	1,455,765
Steel in Austria-Hungary	1,127,104	1,145,654
Coal in Russia	13,985,443	16,151,557
Pig iron in Russia	2,710,972	2,907,299
Steel ingots in Russia	1,903,000	1,830,260
Coal in Holland	212,973	320,225
Coal in Portugal	22,199	24,066
Iron ores in Portugal	15,078	19,803

BRITISH AND GERMAN STATISTICS FOR 1901.

Mr. J. S. Jeans, the secretary of the British Iron Trade Association, reports the production of pig iron, Bessemer steel, and open-hearth steel in Great Britain in 1901 as follows: Pig iron, 7,761,830 long tons, against 8,959,691 tons in 1900, a loss of 1,197,861 tons; Bessemer steel ingots, 1,606,253 tons, against 1,745,004 tons in 1900, a loss of 138,751 tons; open-hearth steel ingots, 3,297,791 tons, against 3,156,050 tons in 1900, a gain of 141,741 tons.

Dr. H. Rentzsch, the statistician of the Association of German Iron and Steel Manufacturers, reports the production of pig iron in Germany and Luxemburg in 1901 as amounting to 7,860,893 metric tons, against 8,520,541 tons in 1900, a loss of 659,648 tons. He also reports the production of steel ingots and castings in Germany and Luxemburg in 1901 as amounting to 6,394,222 metric tons, against 6,645,869 tons in 1900, a loss of 251,647 tons.

Adding the production of pig iron by Great Britain in 1901 to that of Germany and Luxemburg, and reducing metric tons to long tons, gives a total production of pig iron by both countries in 1901 of 15,498,493 long tons, or 379,861 tons less than the production of 15,878,354 tons by the United States in the same year.

Assuming that the production of crucible steel in Great Britain in 1901 amounted to 95,956 long tons, that country's total production of steel in that year would be exactly 5,000,000 tons, her total production of Bessemer and open hearth steel being 4,904,044 tons. Adding Great Britain's estimated total production of steel in 1901 to the total steel production of Germany and Luxemburg in that year, after reducing the latter's production to long tons, gives for both countries a total production in 1901 of 11,293,170 long tons, or 2,180,425 tons less than the production of 13,473,595 tons by the United States in the same year.

From the mining statistics branch of His Majesty's home office it is learned that the total production of coal in Great Britain in 1901 amounted to 219,046,945 long tons, against 225,181,300 tons in 1900, a decrease of 6,134,355 tons. The production of iron ores in Great Britain in 1901 was 12,275,198 tons, against 14,028,208 tons in 1900, a decrease of 1,753,010 tons.

Dr. Rentzsch reports the production of coal in Germany and Luxemburg in 1901, including brown coal, as amounting to 152,628,931 metric tons, against 149,788,256 tons in 1900. and the production of iron ores as amounting to 16,570,258 tons, against 18,964,294 tons in 1900.

GOLD AND SILVER.

By George E. Roberts,

Director of the Mint.

PRODUCTION.

The statistics of the production of gold and silver are furnished, as heretofore, by the Director of the Mint, to whom the statistics collected from the gold and silver mines have also been submitted.

During the calendar year 1901 the United States produced 3,805,500 ounces of gold, valued at $78,666,700; a decrease of $504,300, or 0.636 per cent, as compared with the yield of 1900.

Ten of the nineteen States and Territories yielding gold showed an increased production, California leading, with $1,075,200—an increase due entirely to the normal development of the mining industry. Nevada showed the material gain of $957,600, which came largely from the newly discovered camp of Tonapah, in Nye County, although nearly every county in the State increased its production. South Dakota also made a gain of $301,900, Idaho of $144,600, and Oregon of $123,400. The greatest decrease, amounting to $1,285,300, was in Alaska; this was due to the lateness of the season, which delayed the opening of the placers, and to litigation, which interfered with the development of the industry. Colorado's production diminished $1,135,900, a decrease explained by the decline in the grade of ores extracted, the tonnage having increased.

The silver yield for 1901 amounted to 55,214,000 ounces, of the commercial value of $33,128,400, which was 2,433,000 ounces, or 4.22 per cent, less than it was in 1900. The greatest gain, 1,493,200 ounces, was in Utah, almost all of which came from the Park City district. Nevada, New Mexico, and Washington also made substantial gains. The production of Colorado, owing to the decline in the grade of ores extracted, fell off 2,046,100 fine ounces; Montana's yield diminished 1,063,700 ounces; Idaho's, 886,200, and South Dakota's, 458,200.

The total value of the precious metals produced by the United States in 1901 (silver at commercial value) amounted to $111,795,100, which was $3,117,040, or 2.71 per cent, less than the yield for 1900.

The following table shows the production of gold and silver in the United States from 1792 to 1901, inclusive:

Production of gold and silver in the United States from 1792.

[The estimates for 1792 to 1873 are by Dr. R. W. Raymond, United States mining commissioner, and since by the Director of the Mint.]

Year.	Total.	Gold.	Silver (coining value).
April 2, 1792, to July 31, 1834	$14,000,000	$14,000,000	Small.
July 31, 1834, to Dec. 31, 1844	7,750,000	7,500,000	$250,000
1845	1,058,327	1,008,327	50,000
1846	1,189,357	1,139,357	50,000
1847	939,085	889,085	50,000
1848	10,050,000	10,000,000	50,000
1849	40,050,000	40,000,000	50,000
1850	50,050,000	50,000,000	50,000
1851	55,050,000	55,000,000	50,000
1852	60,050,000	60,000,000	50,000
1853	65,050,000	65,000,000	50,000
1854	60,050,000	60,000,000	50,000
1855	55,050,000	55,000,000	50,000
1856	55,050,000	55,000,000	50,000
1857	55,050,000	55,000,000	50,000
1858	50,500,000	50,000,000	500,000
1859	50,100,000	50,000,000	100,000
1860	46,150,000	46,000,000	150,000
1861	45,000,000	43,000,000	2,000,000
1862	43,700,000	39,200,000	4,500,000
1863	48,500,000	40,000,000	8,500,000
1864	57,100,000	46,100,000	11,000,000
1865	64,475,000	53,225,000	11,250,000
1866	63,500,000	53,500,000	10,000,000
1867	65,225,000	51,725,000	13,500,000
1868	60,000,000	48,000,000	12,000,000
1869	61,500,000	49,500,000	12,000,000
1870	66,000,000	50,000,000	16,000,000
1871	66,500,000	43,500,000	23,000,000
1872	64,750,000	36,000,000	28,750,000
1873	71,750,000	36,000,000	35,750,000
1874	70,800,000	33,500,000	37,300,000
1875	65,100,000	33,400,000	31,700,000
1876	78,700,000	39,900,000	38,800,000
1877	86,700,000	46,900,000	39,800,000
1878	96,400,000	51,200,000	45,200,000
1879	79,700,000	38,900,000	40,800,000
1880	75,200,000	36,000,000	39,200,000
1881	77,700,000	34,700,000	43,000,000
1882	79,300,000	32,500,000	46,800,000
1883	76,200,000	30,000,000	46,200,000
1884	79,600,000	30,800,000	48,800,000
1885	83,400,000	31,800,000	51,600,000
1886	86,000,000	35,000,000	51,000,000
1887	86,350,000	33,000,000	53,350,000
1888	92,370,000	33,175,000	59,195,000
1889:			
Mint	97,446,000	32,800,000	64,646,000
Census	99,282,866	32,886,180	66,396,686

Production of gold and silver in the United States from 1792—Continued.

Year.	Total.	Gold.	Silver (coining value).
1890	$103,309,645	$32,845,000	$70,464,645
1891	108,591,565	33,175,000	75,416,565
1892	115,009,150	33,000,000	82,099,150
1893	113,525,757	35,950,000	77,575,757
1894	103,500,000	39,500,000	64,000,000
1895	118,661,000	46,610,000	72,051,000
1896	129,157,236	53,088,000	76,069,236
1897	127,000,172	57,363,000	69,637,172
1898	134,847 485	64,463,000	70,384,485
1899	141,860,026	71,053,400	70,806,626
1900	153,704,495	79,171,000	74,533,495
1901	150,054,500	78,666,700	71,387,800

The following table shows the production of gold in the United States in 1900 and 1901 and the increase or decrease in 1901, by States and Territories:

Production of gold in the United States in 1900 and 1901 and the increase or decrease in 1901, by States and Territories.

State or Territory.	1900.	1901.	Increase.	Decrease.
Alaska	$8,171,000	$6,885,700	....	$1,285,300
Arizona	4,193,400	4,083,000	....	110,400
California	15,816,200	16,891,400	$1,075,200	....
Colorado	28,829,400	27,693,500	....	1,135,900
Georgia	116,700	124,500	7,800	....
Idaho	1,724,700	1,869,300	144,600	....
Michigan	29,000	30,800	1,800	....
Montana	4,698,000	4,744,100	46,100	....
Nevada	2,006,200	2,963,800	957,600	....
New Mexico	832,900	688,400	....	144,500
North Carolina	28,500	55,500	27,000	....
Oregon	1,694,700	1,818,100	123,400	....
South Carolina	121,000	46,700	....	74,300
South Dakota	6,177,600	6,479,500	301,900	....
Texas	1,100	600	....	500
Utah	3,972,200	3,690,200	....	282,000
Washington	718,200	580,500	....	137,700
Wyoming	34,200	12,700	....	21,500
Alabama	6,000	8,400	2,400	....
Maryland				
Missouri				
Tennessee				
Virginia				
Total	79,171,000	78,666,700	2,687,800	3,192,100
Net decrease	....	....	....	504,300

The following table shows the production of silver in the United States in 1900 and 1901 and the increase or decrease in 1901, by States and Territories:

Production of silver in the United States in 1900 and 1901 and the increase or decrease in 1901, by States and Territories.

State or Territory.	Weight.			
	1900.	1901.	Increase.	Decrease.
	Fine ounces.	*Fine ounces.*	*Fine ounces.*	*Fine ounces.*
Alabama	100	100		
Alaska	73,300	47,900		25,400
Arizona	2,995,500	2,812,400		183,100
California	941,400	925,600		15,800
Colorado	20,483,900	18,437,800		2,046,100
Georgia	400	400		
Idaho	6,429,100	5,542,900		886,200
Michigan	102,000	81,000		21,000
Montana	14,195,400	13,131,700		1,063,700
Nevada	1,358,700	1,812,500	453,800	
New Mexico	434,300	563,400	129,100	
North Carolina	11,200	20,300	9,100	
Oregon	115,400	160,100	44,700	
South Carolina	400	200		200
South Dakota	536,200	78,000		458,200
Texas	477,400	472,400		5,000
Utah	9,267,600	10,760,800	1,493,200	
Virginia		700	700	
Washington	224,500	344,400	119,900	
Wyoming	200	21,400	21,200	
Total	57,647,000	[a]55,214,000	2,271,700	4,704,700
Net decrease				2,433,000

[a] Commercial value, $33,128,400; coining value, $71,387,800.

The following table shows the approximate distribution of the production, by States and Territories, of gold and silver in the United States in 1901:

Approximate distribution of the production of gold and silver in the United States for the calendar year 1901, by producing States and Territories.

[As estimated by the Director of the Mint.]

State or Territory.	Gold.		Silver.			Total value (silver at commercial value).
	Quantity.	Value.	Quantity.	Coining value.	Commercial value.	
	Fine ounces.		*Fine ounces.*			
Alabama	150	$3,100	100	$129	$60	$3,160
Alaska	333,096	6,885,700	47,900	61,931	28,740	6,914,440
Arizona	197,515	4,083,000	2,812,400	3,636,234	1,687,440	5,770,440
California	817,121	16,891,400	925,600	1,196,736	555,360	17,446,760
Colorado	1,339,673	27,693,500	18,437,800	23,838,772	11,062,680	38,756,180
Georgia	6,023	124,500	400	517	240	124,740
Idaho	90,427	1,869,300	5,542,900	7,166,578	3,325,740	5,195,040
Michigan	1,490	30,800	81,000	104,727	48,600	79,400

Approximate distribution of the production of gold and silver in the United States for the calendar year 1901, by producing States and Territories—Continued.

State or Territory.	Gold.		Silver.			Total value (silver at commercial value).
	Quantity.	Value.	Quantity.	Coining value.	Commercial value.	
	Fine ounces.		*Fine ounces.*			
Montana	229,495	$4,744,100	13,131,700	$16,978,360	$7,879,020	$12,623,120
Nevada	143,374	2,963,800	1,812,500	2,343,435	1,087,500	4,051,300
New Mexico	33,302	688,400	563,400	728,436	338,040	1,026,440
North Carolina	2,685	55,500	20,300	26,246	12,180	67,680
Oregon	87,950	1,818,100	160,100	206,998	96,060	1,914,160
South Carolina	2,259	46,700	200	259	120	46,820
South Dakota	313,446	6,479,500	78,000	100,849	46,800	6,526,300
Texas	29	600	472,400	610,780	283,440	284,040
Utah	178,513	3,690,200	10,760,800	13,912,954	6,456,480	10,146,680
Virginia	256	5,300	700	905	420	5,720
Washington	28,082	580,500	344,400	445,285	206,640	787,140
Wyoming	614	12,700	21,400	27,669	12,840	25,540
Total	3,805,500	78,666,700	55,214,000	71,387,800	33,128,400	111,795,100

The following table shows the distribution of the production of gold and silver in 1901 according to sources of production:

Distribution of the production of gold and silver in the United States for the calendar year 1901, as to sources of production.

[As reported by officers and agents of the Mint.]

State or Territory.	Gold.		Silver.		
	Quartz.	Placer.	Quartz.	Lead ores.	Copper ores.
	Fine ounces.	*Fine ounces.*	*Fine ounces.*	*Fine ounces.*	*Fine ounces.*
Alabama	116	67	41	....	....
Alaska	94,957	240,389	51,433	....	....
Arizona	197,900	5,081	1,795,000	205,000	1,200,000
California	630,713	191,132	195,369	47,122	708,340
Colorado	1,313,687	29,025	4,639,267	[a]13,917,801	....
Georgia	6,266	873	673	....	....
Idaho	56,289	36,461	1,080.352	4,511,382	....
Maryland	7	....	....	....	....
Michigan	1,490	....	....	....	81,031
Montana	207,045	25,286	3,646,623	397,029	10,136,893
Nevada	148,321	1,621	1,619,443	402,188	....
New Mexico	31,768	2,889	201,785	130,626	435,419
North Carolina	2,026	896	....	99	26,216
Oregon	19,969	68,790	160,503	3,370	....
South Carolina	5,775	383	307	....	....
South Dakota	314,855	....	84,461	....	....
Tennessee	12	....	....	5	....
Texas	30	....	472,423	....	....
Utah	184,803	....	1,761,234	7,357,482	2,201,144
Virginia	185	128	617	....	427
Washington	27,034	4,953	329,677	46,240	1,464
Wyoming	....	2,000	25,000	....	....
Total	3,243,248	609,974	16,064,208	27,018,344	14,790,934

[a] Lead and copper ores.

The following table shows the production of gold in the famous Cripple Creek district of Colorado for the eleven years from 1891 to 1901, inclusive:

Production of gold in Cripple Creek district, Colorado, 1891–1901.

1891	$2,000
1892	583,010
1893	2,010,367
1894	2,908,702
1895	6,879,137
1896	7,512,911
1897	10,139,708
1898	13,507,244
1899	15,658,254
1900	18,073,539
1901	17,261,579
Total	94,536,451

The following table shows the production of gold in the United States in 1899 and 1900 and the increase or decrease in 1900, by States and Territories:

Production of gold in the United States in 1899 and 1900 and the increase and decrease in 1900, by States and Territories.

State or Territory.	Value.			
	1899.	1900.	Increase.	Decrease.
Alaska	$5,459,500	$8,171,000	$2,711,500	
Arizona	2,566,100	4,193,400	1,627,300	
California	15,197,800	15,816,200	618,400	
Colorado	25,982,800	28,829,400	2,846,600	
Georgia	113,000	116,700	3,700	
Idaho	1,889,000	1,724,700		$164,300
Michigan	100	29,000	28,900	
Montana	4,760,100	4,698,000		62,100
Nevada	2,219,000	2,006,200		212,800
New Mexico	584,100	832,900	248,800	
North Carolina	34,500	28,500		6,000
Oregon	1,429,500	1,694,700	265,200	
South Carolina	160,100	121,000		39,100
South Dakota	6,469,500	6,177,600		291,900
Texas	6,900	1,100		5,800
Utah	3,450,800	3,972,200	521,400	
Washington	685,400	718,200	32,800	
Alabama Maryland Minnesota Tennessee Vermont Virginia Wyoming Maine Missouri	45,200	40,200		5,000
Total	71,053,400	[a]79,171,000	8,904,600	787,000
Net increase			8,117,600	

[a] 3,829,897 fine ounces.

The following table shows the production of silver in the United States in 1899 and 1900 and the increase or decrease in 1900, by States and Territories:

Production of silver in the United States in 1899 and 1900 and the increase or decrease in 1900, by States and Territories.

State or Territory.	Weight.			
	1899.	1900.	Increase.	Decrease.
	Fine ounces.	*Fine ounces.*	*Fine ounces.*	*Fine ounces.*
Alabama	100	100		
Alaska	140, 100	73, 300		66, 800
Arizona	1, 578, 300	2, 995, 500	1, 417, 200	
California	824, 300	941, 400	117, 100	
Colorado	22, 662, 900	20, 483, 900		2, 179, 000
Georgia	400	400		
Idaho	3, 851, 800	6, 429, 100	2, 577, 300	
Michigan	112, 800	102, 000		10, 800
Montana	16, 096, 000	14, 195, 400		1, 900, 600
Nevada	843, 400	1, 358, 700	515, 300	
New Mexico	503, 300	434, 300		69, 000
North Carolina	300	11, 200	10, 900	
Oregon	134, 300	115, 400		18, 900
South Carolina	400	400		
South Dakota	145, 600	536, 200	390, 600	
Texas	520, 000	477, 400		42, 600
Utah	7, 093, 300	9, 267, 600	2, 174, 300	
Washington	256, 000	224, 500		31, 500
Wyoming	400	200		200
Maryland	100			100
Virginia	100			100
Maine	500			500
Missouri	100			100
Total	54, 764, 500	[a] 57, 647, 000	7, 202, 700	4, 320, 200
Net increase			2, 882, 500	

[a] Commercial value, $35,741,100.

The following table shows the distribution of the production of gold and silver in the United States in 1899, by producing States and Territories:

Approximate distribution of the production of gold and silver in the United States for the calendar year 1899, by producing States and Territories.

[As estimated by the Director of the Mint.]

State or Territory.	Gold.		Silver.		Total value.
	Quantity.	Value.	Quantity.	Coining value.	
	Fine ounces.		*Fine ounces.*		
Alabama	208	$4,300	100	$129	$4,429
Alaska	264,104	5,459,500	140,100	181,140	5,640,640
Arizona	124,133	2,566,100	1,578,300	2,040,630	4,606,730
California	735,194	15,197,800	824,300	1,065.762	16,263,562
Colorado	1,256,920	25,982,800	22,662,900	29,301,527	55,284,327
Georgia	5,466	113,000	400	517	113,517
Idaho	91,380	1,889,000	3.851,800	4,980,105	6,869,105
Maine	174	3,600	500	646	4,246
Maryland	39	800	100	129	929
Michigan	5	100	112,800	145,843	145,943
Missouri	5	100	100	129	229
Montana	230,270	4,760,100	16,096,000	20,810,990	25,571,090
Nevada	107,344	2,219,000	843,400	1,090,457	3,309,457
New Mexico	28,256	584,100	503,300	650,731	1,234,831
North Carolina	1,669	34,500	300	388	34,888
Oregon	69,152	1,429,500	134,300	173,641	1,603,141
South Carolina	7,745	160,100	400	517	160,617
South Dakota	312,962	6,469,500	145,600	188,251	6,657,751
Texas	334	6,900	520,000	672,323	679,223
Utah	166,933	3,450,800	7,093,300	9,171,135	12,621,935
Vermont	5	100			100
Virginia	343	7,100	100	129	7,229
Washington	33,156	685,400	256,000	330,990	1,016,390
Wyoming	1,413	29,200	400	517	29,717
Total	3,437,210	71,053,400	54,764,500	70,806,626	141,860,026

The following table shows the distribution of the production of gold and silver in the United States in 1900, by producing States and Territories:

Approximate distribution of the production of gold and silver in the United States for the calendar year 1900, by producing States and Territories.

[As estimated by the Director of the Mint.]

State or Territory.	Gold.		Silver.			Total value (silver at commercial value).
	Quantity.	Value.	Quantity.	Coining value.	Commercial value.	
	Fine ounces.		*Fine ounces.*			
Alabama	92	$1,900	100	$129	$62	$1,962
Alaska	395,271	8,171,000	73,300	94,772	45,446	8,216,446
Arizona	202,856	4,193,400	2,995,500	3,872,970	1,857,210	6,050,610
California	765,109	15,816,200	941,400	1,217,165	583,668	16,399,868
Colorado	1,394,622	28,829,400	20,483,900	26,484,234	12,700,018	41,529,418
Georgia	5,644	116,700	400	517	248	116,948
Idaho	83,433	1,724,700	6,429,100	8,312,372	3,986,042	5,710,742
Maryland	5	100	....	....	....	100
Michigan	1,403	29,000	102,000	131,879	63,240	92,240
Missouri	33	700	....	....	....	700
Montana	227,266	4,698,000	14,195,400	18,353,648	8,801,148	13,499,148
Nevada	97,050	2,006,200	1,358,700	1,756,703	842,394	2,848,594
New Mexico	40,292	832,900	434,300	561,519	269,266	1,102,166
North Carolina	1,379	28,500	11,200	14,481	6,944	35,444
Oregon	81,980	1,694,700	115,400	149,204	71,548	1,766,248
South Carolina	5,854	121,000	400	517	248	121,248
South Dakota	298,842	6,177,600	536,200	693,269	332,444	6,510,044
Tennessee	5	100	....	....	....	100
Texas	53	1,100	477,400	617,244	295,988	297,088
Utah	192,155	3,972,200	9,267,600	11,982,351	5,745,912	9,718,112
Virginia	155	3,200	....	....	....	3,200
Washington	34,743	718,200	224,500	290,263	139,190	857,390
Wyoming	1,655	34,200	200	258	124	34,324
Total	3,829,897	79,171,000	57,647,000	74,533,495	35,741,140	114,912,140

The following table shows the distribution of the production of gold and silver in the United States in 1900 as to the sources of production:

Approximate distribution of the production of gold and silver in the United States for the calendar year 1900, by producing States and Territories, as to sources of production.

[As reported by officers and agents of the mint.]

State or Territory.	Gold.		Silver.		
	Quartz.	Placer.	Quartz.	Lead ores.	Copper ores.
	Fine ounces.	*Fine ounces.*	*Fine ounces.*	*Fine ounces.*	*Fine ounces.*
Alabama	62	65	50		
Alaska	101,095	293,944	74,818		
Arizona	196,494	9,100	2,571,977	225,732	1,452,291
California	607,485	159,905	614,412	54,713	499,032
Colorado	1,361,643	34,914	4,802,856	[a] 16,079,127	
Georgia	4,535	1,489	489		
Idaho	56,804	43,721	1,021,153	5,528,965	
Maryland	10	9	2		
Michigan	1,401				102,042
Montana	202,406	26,709	2,835,948	2,134,802	9,324,085
Nevada	96,911	990	1,125,000	368,566	
New Mexico	39,140	3,628	139,619	90,000	300,000
North Carolina	888	1,272	12,364		
Oregon	68,319	15,268	79,668	52,374	
South Carolina	5,628	306	391		
South Dakota	300,955		558,903		
Tennessee		15	1		
Texas	53		477,400		
Utah	195,223		2,027,038	5,912,184	1,442,462
Virginia	78	94	96		
Washington	30,664	4,768	154,270	146,300	2,000
Wyoming		1,653	256		
Total	3,269,794	597,850	16,496,711	30,592,763	13,121,912

[a] Lead and copper ores.

MANGANESE ORES.

By John Birkinbine.

PRODUCTION.

SUMMARY OF PRODUCTION AND VALUE.

The total production of manganese ore in the United States during the year ending December 31, 1901, amounted to 11,995 long tons, valued at $116,722, an average of $9.73 per ton. This was an increase of 224 tons, or about 2 per cent, over the 1900 output of 11,771 long tons, but the average value increased from $8.52 in 1900 to $9.73 in 1901, or $1.21 per ton.

In 1901 eight States contributed to the total, Alabama, Missouri, and Utah being added to the 1900 list. Montana, a former producer, reported no ore mined. Virginia, as in 1900, heads the list, Georgia being second, and Utah ranks third.

The following table shows the production, total valuation, and average value per ton at the mines for the years 1896 to 1901, inclusive:

Production and value of manganese ores in the United States from 1896 to 1901, inclusive.

State.	1896.			1897.			1898.		
	Quantity.	Value.	Average value per ton.	Quantity.	Value.	Average value per ton.	Quantity.	Value.	Average value per ton.
	Long tons.			*Long tons.*			*Long tons.*		
Alabama	....	....	....	....	....	....	22	[a]$143	[a]$6.50
Arkansas	3,421	$36,686	$10.72	3,240	$33,708	$10.40	2,662	26,035	9.78
California	284	3,415	12.02	484	2,788	5.76	541	3,222	5.96
Georgia	4,085	27,032	6.62	3,332	22,084	6.63	6,689	41,571	6.21
Michigan	....	....	....	37	370	10.00	....	....	....
Missouri	....	....	....	....	....	....	....	....	....
Montana	....	....	....	....	....	....	....	....	....
North Carolina	2	17	8.50	....	....	....	....	....	....
Pennsylvania	265	1,988	7.50	354	2,832	8.00	....	....	....
Tennessee	....	....	....	11	93	8.45	381	2,276	5.97
Virginia	2,018	21,485	10.65	3,650	33,630	9.21	5,662	55,938	9.88
West Virginia	13	104	8.00	....	....	....	....	....	....
Total	10,088	90,727	8.99	11,108	95,505	8.60	15,957	129,185	8.10

[a] Estimated.

Production and value of manganese ores in the United States, etc.—Continued.

State.	1899.			1900.			1901.		
	Quantity.	Value.	Average value per ton.	Quantity.	Value.	Average value per ton.	Quantity.	Value.	Average value per ton.
	Long tons.			*Long tons.*			*Long tons.*		
Alabama	....	....	....	....	....	....	17	$111	$6.50
Arkansas	356	$3,781	$10.62	145	$1,530	$10.55	91	657	7.22
California	115	855	7.43	131	1,310	10.00	610	3,610	5.92
Georgia	3,089	23,377	7.57	3,447	26,816	7.78	4,074	24,674	6.06
Michigan	....	....	....	....	....	....	....	....	....
Missouri	16	160	10.00	....	....	....	28	280	10.00
Montana	....	....	....	137	514	3.75	....	....	....
North Carolina	90	765	8.50	....	....	....	....	....	....
Pennsylvania	12	58	4.83	....	....	....	....	....	....
Tennessee	19	133	7.00	30	195	6.50	400	3,287	8.22
Utah	....	....	....	....	....	....	2,500	31,250	12.50
Virginia	6,228	53,069	8.52	7,881	69,924	8.87	4,275	52,853	12.36
West Virginia	10	80	8.00	....	....	....	....	....	....
Total	9,935	82,278	8.28	11,771	100,289	8.52	11,995	116,722	9.73

This epitome suggests that the domestic manganese industry has not developed into one of importance as far as quantity is concerned. The bulk of the supply still comes from foreign countries.

Virginia, Georgia, and Utah combined produced 10,849 tons, or 90 per cent of the total for the United States.

The two first-mentioned States and Arkansas (which now supplies but a small amount of ore) have heretofore been the principal contributors of manganese ore, as will be seen from the following table:

Production of manganese ores in the United States from 1880 to 1901, inclusive.

[Maxima are given in italics.]

Year.	Virginia.	Georgia.	Arkansas.	Other States.	Total production.	Total value.
	Long tons.	*Long tons.*	*Long tons.*	*Long tons.*	*Long tons.*	
1880	3,661	1,800	....	300	5,761	$86,415
1881	3,295	1,200	100	300	4,895	73,425
1882	2,982	1,000	175	375	4,532	67,980
1883	5,355	....	400	400	6,155	92,325
1884	8,980	....	800	400	10,180	122,160
1885	18,745	2,580	1,483	450	23,258	190,281
1886	*20,567*	6,041	3,316	269	30,193	277,636
1887	19,835	*9,024*	5,651	14	*34,524*	*333,844*
1888	17,646	5,568	4,312	1,672	29,198	279,571
1889	14,616	5,208	2,528	1,845	24,197	240,559
1890	12,699	749	5,339	*6,897*	25,684	219,050
1891	16,248	3,575	1,650	1,943	23,416	239,129
1892	6,079	826	*6,708*	....	13,613	129,586
1893	4,092	724	2,020	882	7,718	66,614
1894	1,797	1,277	1,934	1,300	6,308	53,635
1895	1,715	3,856	2,991	985	9,547	71,769
1896	2,018	4,085	3,421	564	10,088	90,727
1897	3,650	3,332	3,240	886	11,108	95,505
1898	5,662	6.689	2,662	944	15,957	129,185
1899	6,228	3,089	356	262	9,935	82,278
1900	7,881	3,447	145	298	11,771	100,289
1901	4,275	4,074	91	3,555	11,995	116,722
Total for 22 years	188,026	68,144	49,322	24,541	330,033	3,158,685

PRODUCTION OF MANGANIFEROUS IRON ORES.

Following the custom of former years, the manganiferous iron ores are included in the report on iron ores, and are also noted here as of interest.

It is generally known that most of the Lake Superior ores carry manganese, but, except in a few cases, the amount does not exceed 1 per cent.

The output of Colorado and a portion of the output of the Lake Superior region were utilized in the manufacture of spiegeleisen.

North Carolina mined, as a prospect, 20 tons of manganiferous iron ore, which was not shipped, and of which the definite composition is unknown.

The production, percentage of manganese, and total and average value of the manganiferous iron ores produced in the United States in 1901 were as follows:

Production, percentage of manganese, and total and average value of manganiferous iron ores in 1901.

Locality.	Production.	Percentage of manganese.	Reported total value at mines.	Average value per ton.
	Long tons.			
Colorado	62,385	16 to 30	$248,084	$3.98
Lake Superior region	512,084	1 to 10	1,226,952	2.40
North Carolina	20	Not given.	48	2.40
Total	574,489	1 to 30	1,475,084	2.57

The annual production, valuation, and average value per ton of the manganiferous iron ores mined from 1889 to 1901, inclusive, are given in the following table:

Production of manganiferous iron ores in the United States from 1889 to 1901, inclusive.

[Maxima in italics.]

Year.	Quantity.	Value.	Average value per ton.
	Long tons.		
1889	83,434	$271,680	$3.26
1890	61,863	231,655	*3.74*
1891	132,511	314,099	2.37
1892	153,373	354,664	2.31
1893	117,782	283,228	2.40
1894	205,488	408,597	1.99
1895	125,729	233,998	1.86
1896	338,712	726,413	2.14
1897	202,304	343,784	1.70
1898	287,810	429,302	1.49
1899	*761,845*	1,147,047	1.51
1900	377,577	1,037,314	2.75
1901	574,489	*1,475,084*	2.57

PRODUCTION OF MANGANIFEROUS SILVER ORES.

In mining some argentiferous ores a considerable amount of manganiferous iron ore is obtained which carries insufficient percentage of the precious metal to make it valuable on that account, and it is used as a flux by smelters.

This ore was also included in the report on iron ores. The amounts produced from 1889 to 1901, inclusive, together with the total and average values, are as follows:

Production of manganiferous silver ores in the United States from 1889 to 1901, inclusive.

[Maxima in italics.]

Year.	Quantity.	Value.	Average value per ton.
	Long tons.		
1889	64,987	$227,455	$3.50
1890	51,840	181,440	3.50
1891	79,511	397,555	5.00
1892	62,309	323,794	*5.20*
1893	[a] 55,962	258,695	4.75
1894	[b] 31,687	148,292	4.84
1895	54,163	229,651	4.24
1896	138,079	416,020	3.01
1897	149,502	424,151	2.84
1898	99,651	295,412	2.96
1899	79,855	266,343	3.34
1900	188,509	*897,068*	4.76
1901	*228,187*	865,959	3.79

[a] Including 1,500 tons from Montana, for which no value is given.

[b] Including 1,049 tons from Montana, for which no value is given.

PRODUCTION OF MANGANIFEROUS ZINC ORES.

The clinker obtained by roasting the franklinite ores of New Jersey to extract the zinc contains iron and manganese; this is employed in the production of spiegeleisen, 52,311 tons being the total so used in 1901.

The production and the total and average values of zinc residuum or clinker from 1889 to 1901 are given below:

Production of manganiferous zinc ore residuum in the United States from 1889 to 1901, inclusive.

[Maxima in italics.]

Year.	Quantity.	Value.	Average value per ton.
	Long tons.		
1889	43,648	$54,560	$1.25
1890	48,560	*60,700*	1.25
1891	38,228	57,432	*1.50*
1892	31,859	25,937	.81
1893	37,512	30,535	.81
1894	26,981	20,464	.76
1895	43,249	24,451	.57
1896	44,953	20,455	.46
1897	33,924	18,713	.55
1898	48,502	[a] 26,676	.55
1899	65,010	32,505	.50
1900	*87,110*	34,844	.40
1901	52,311	52,311	1.00

[a] Estimated.

RÉSUMÉ OF PRODUCTION OF MANGANESE AND MANGANIFEROUS ORES.

Following is a résumé of the production in the United States of the different ores containing manganese, together with the total and average value per ton:

Production of manganese and manganiferous ores in the United States in 1901.

Kind of ore.	Quantity.	Value.	Average value per ton.
	Long tons.		
Manganese ores	11,995	$116,722	$9.73
Manganiferous iron ores	574,489	1,475,084	2.57
Manganiferous silver ores	228,187	865,959	3.79
Manganiferous zinc residuum [a]	52,311	52,311	1.00
Total	866,982	2,510,076	2.90

[a] As this is a by-product in the treatment of zinc ores, the value given to it is nominal.

PRODUCTION OF MANGANESE ORES, BY STATES.

The sources of supply in the various States will next be considered.

ALABAMA.

This State contributed a sample lot—17 tons—of manganese ore in 1901.

ARKANSAS.

A decade ago Arkansas was the principal manganese-producing State in the Union, but in late years the industry has shown a decadence, gradually declining from 3,421 tons in 1896 to but 91 tons in 1901. All of this ore comes from the Batesville district.

There are numerous deposits of ore in this State carrying satisfactory percentages of manganese, but the high phosphorus content, in addition to the distance from the point of consumption and the expense of mining, has rendered much of it unmarketable. It is possible that in the future, if railroads are extended toward the White River from Cushman, an increase may be expected. The total amount of ore obtained from the Batesville district from 1850 to 1901, inclusive, is 49,892 long tons, the maximum product being 6,708 tons in 1892.

Production of manganese in the Batesville district of Arkansas from 1850 to 1901, inclusive.

[Maximum in italics.]

Year.	Authority.	Quantity.
		Long tons.
1850 to 1867	Estimated	400
1868	do	10
1881	Railroad reports of shipments	100
1882	do	175
1883	do	400
1884	do	800
1885	Mineral Resources of the United States	1,483
1886	do	3,316
1887	do	5,651
1888	do	4,312
1889	Eleventh Census	2,528
1890	Mineral Resources of the United States	5,339
1891	do	1,650
1892	do	*6,708*
1893	do	2,180
1894	do	1,934
1895	do	2,991
1896	do	3,421
1897	do	3,240
1898	do	2,662
1899	do	356
1900	do	145
1901	do	91
Total		49,892

CALIFORNIA.

Exploited deposits of manganese ore occur in the counties of Alameda, Marin, Napa, San Benito, San Luis Obispo, Santa Clara, and Sonoma, but only those in Alameda County are operated. The amount reported during the year 1901, 610 tons, is the largest since the year 1891. The total production of manganese ores in California from 1874 to the close of 1901 is reported as 10,512 tons, the maximum being 705 tons in 1891.

Total production of manganese ores in California from 1874 to 1901, inclusive.

Year.	Quantity.	Year.	Quantity.
	Long tons.		*Long tons.*
1874 to 1888	6,000	1896	284
1889	53	1897	484
1890	386	1898	541
1891	705	1899	115
1892	....	1900	131
1893	400	1901	610
1894	278	Total	10,512
1895	525		

COLORADO.

Considerable amounts of both manganiferous iron ores and manganiferous silver ores are annually mined in Colorado, principally in the Leadville district, the former being used by the steel works in the production of spiegeleisen, and the latter being utilized as a flux by the smelters.

There are also other argentiferous and manganiferous ores which contain enough of the precious metals to make them valuable on that account, and which are, therefore, not considered in this report.

The production of argentiferous and manganiferous iron ores, as reported to this office, from 1889 to 1901, inclusive, is as follows:

Production of manganiferous ores in Colorado from 1889 to 1901, inclusive.

Ore.	1889.	1890.	1891.	1892.	1893.	1894.	1895.
	Long tons.	*Long tons.*	*Long tons.*	*Long tons.*	*Long tons.*	*Long tons.*	*Long tons.*
Manganiferous iron ores used for producing spiegeleisen	2,075	....	964	3,100	5,766	7,022	13,464
Manganiferous silver ores	64,987	51,840	79,511	62,309	54,462	30,187	53,506
Total	67,062	51,840	80,475	65,409	60,228	37,209	66,970

Ore.	1896.	1897.	1898.	1899.	1900.	1901.
	Long tons.	*Long tons.*	*Long tons.*	*Long tons.*	*Long tons.*	*Long tons.*
Manganiferous iron ores used for producing spiegeleisen	9,072	16,519	18,848	29,355	43,303	62,385
Manganiferous silver ores	137,597	149,502	99,651	79,855	188,509	228,187
Total	146,669	166,021	118,499	109,210	231,812	290,572

GEORGIA.

In 1901 the Cave Spring district and the Cartersville district both mined manganese ore (the latter being the principal producer), swelling the total for the year to 4,074 long tons, the largest production since 1898.

The annual production from 1866 to 1901 is given below, from which it will be seen that the grand total during this period amounts to 88,094 long tons.

Production of manganese ores in Georgia from 1866 to 1901, inclusive.

Year.	Quantity.
	Long tons.
From 1866 to 1873 (estimated)	5,550
1874	2,400
1875	2,400
1876	2,400
1877	2,400
1878	2,400
1879	2,400
1880	1,800
1881	1,200
1882	1,000
1883 and 1884	(*a*)
1885	2,580
1886	6,041
1887	9,024
1888	5,568
1889	5,208
1890	749
1891	3,575
1892	8 6
1893	724
1894	1,277
1895	3,856
1896	4,085
1897	3,332
1898	6,689
1899	3,089
1900	3,447
1901	4,074
Total	88,094

a None reported.

LAKE SUPERIOR REGION.

In the Lake Superior region considerable amounts of iron ore are obtained carrying from 1 to 10 per cent of manganese, the total amount mined in 1901 being 512,084 long tons. Of this amount approximately 245,000 tons carried under 5 per cent of manganese, and the remainder from 5 to 10 per cent.

MISSOURI.

In the year 1901, 28 tons of manganese ore were obtained in this State, but it is uncertain whether the shipments of ore will continue.

TENNESSEE.

This State reported in 1901 its largest production of manganese ores since the United States Geological Survey has been collecting statistics, viz. 400 tons.

The amounts of ore mined annually from 1897 to 1901 are as follows:

Production of manganese ores in Tennessee from 1897 to 1901, inclusive.

Year.	Quantity.
	Long tons.
1897	11
1898	381
1899	19
1900	30
1901	400

UTAH.

A manganese deposit has been developed near Thompson, Utah, and a wagon road 16 miles long has been built from the mine to the Little Grand. About 2,500 tons were broken down at the mine during the year, of which 500 tons were shipped to steel works at Pueblo, Colo., and Chicago, Ill.

The deposit is reported as lying between bedding planes of Triassic sandstone, the ore yielding 42 to 58 per cent of manganese.

Indications are favorable for obtaining a liberal supply from this deposit.

VIRGINIA.

Virginia shows a falling off of 3,606 tons from the 1900 total of 7,881 long tons, the amount mined in 1901 being but 4,275 tons.

The yearly production from 1880 to 1901 is given below, the total output being 188,026 long tons.

Production of manganese ores in Virginia from 1880 to 1901, inclusive.

[Maximum in italics.]

Year.	Quantity.	Year.	Quantity.
	Long tons.		*Long tons.*
1880	3,661	1892	6,079
1881	3,295	1893	4,092
1882	2,982	1894	1,797
1883	5,355	1895	1,715
1884	8,980	1896	2,018
1885	18,745	1897	3,650
1886	*20,567*	1898	5,662
1887	19,835	1899	6,228
1888	17,646	1900	7,881
1889	14,616	1901	4,275
1890	12,699	Total	188,026
1891	16,248		

IMPORTS.

The greater part of the manganese ores used in the United States is imported from various foreign countries, the amount brought in during the year 1901 being 165,722 long tons, valued at $1,486,573, or $8.97 per ton. The principal shippers in 1901 were Brazil, Russia, Cuba, Turkey, Chile, and India, in the order named. Ore is also obtained from Japan, Spain, Germany, Colombia, England, etc.

The following table will show the imports of manganese ores into the United States during the calendar years 1899, 1900, and 1901, inclusive, by countries, together with the valuations of the ores:

Imports of manganese ores into the United States during the calendar years 1899, 1900, and 1901, by countries.

Country.	1899.		1900.		1901.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Long tons.		*Long tons.*		*Long tons.*	
Brazil	28,115	$299,877	54,451	$590,825	48,029	$460,024
Russia, Black Sea	73,397	598,644	132,121	812,592	32,600	224,798
British East Indies	17,950	54,471	10,650	30,787	11,000	40,148
Cuba	16,359	221,785	20,582	259,348	21,627	307,084
Chile	17,575	111,726	9,925	69,670	14,794	101,364
Colombia	8,900	82,489	7,902	86,678	2,600	34,800
Turkey in Asia	5,782	46,822	7,062	49,482	5,980	43,653
Turkey in Europe	8,310	61,241	6,186	43,593	11,879	87,380
Japan	4,492	31,657	5,338	44,707	5,985	52,443
France	2,953	21,080	....	....	....	....
Germany	1,274	34,927	1,696	43,025	4,184	76,827
United Kingdom	134	6,697	156	7,466	468	10,563
French West Indies	....	....	65	650	....	....
Greece	3,030	10,526	50	897	....	....
Quebec, Ontario, etc	....	....	39	1,100	468	3,669
Nova Scotia, New Brunswick, etc.	78	2,586	19	1,114	29	1,110
Austria-Hungary	....	....	10	427	....	....
Spain	....	....	....	....	6,050	38,947
Netherlands	....	....	....	....	29	763
Total	188,349	1,584,528	256,252	2,042,361	165,722	1,486,573

The United States is the largest producer of steel in the world, the amount manufactured in 1901 being approximately 13⅓ million tons, and in the production of this steel a large amount of ferro-manganese and spiegeleisen is used.

It is estimated that the manganese requirements average—

11 pounds per ton of ingots for open-hearth steel;
16 pounds per ton of ingots for soft Bessemer steel;
31 pounds per ton of ingots for rail Bessemer steel.

In the year 1900 the bulk of "ferro" and "spiegel" was manufactured in the United States principally from imported ores, but during the year 1901 the foreign ferro and spiegel were attractively low in price, and the demand in this country for prompt deliveries of pig iron was brisk, so that a number of the larger companies preferred to keep their blast furnaces on Bessemer mixtures and to import such manganese metal as might be required, rather than to manufacture it. This will account for the falling off in the imports of manganese ore in 1901, when it would be supposed that, in view of the large amount of steel produced, they would have increased.

The importations by customs districts show that over half of the total foreign manganese ore was received at the port of Baltimore, about one-seventh at Philadelphia, and that the remainder was scattered among a number of ports, principally on the Atlantic seaboard, as will be seen from the following table:

Manganese ore imported into the United States during the calendar years 1899, 1900, and 1901, by customs districts.

Customs district.	1901.		1900.		1899.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Long tons.		*Long tons.*		*Long tons.*	
Philadelphia, Pa	24,396	$188,869	80,333	$726,545	90,583	$655,061
Baltimore, Md	120,579	1,004,750	161,932	1,134,823	80,006	739,547
New York, N. Y	8,103	110,979	13,883	176,944	14,762	152,959
Norfolk, Va	....	....	....	....	2,901	32,248
Pittsburg, Pa	40	2,994	25	1,578	44	2,473
Newport News, Va	26	862	15	568	26	1,351
Chicago, Ill	48	2,392	....	....	16	595
Boston, Mass	25	691	1	24	5	116
Passamaquoddy, Me	....	....	2	30	4	82
Pensacola, Fla	8,935	127,159	....	....	....	....
Mobile, Ala	3,100	44,100	....	....	....	....
Huron, Mich	396	3,170	....	....	....	....
Champlain, Mich	72	499	....	....	....	....
All others	2	108	61	1,849	2	96
Total	165,722	1,486,573	256,252	2,042,361	188,349	1,584,528

The comparative figures of the production of manganese ore in the United States and the amounts imported from the years 1889 to 1901, inclusive, appear in the following table. These indicate a gradually increased importation of manganese ore, with but four exceptions, from 1889 to 1900, inclusive, while in the year 1901 there was a falling off to 165,722 tons, a decline of 90,530 tons from the maximum of 256,252 long tons in 1900. The average domestic production for thirteen years amounted to 13,949 tons, valued at $125,773, while the imports in the same period showed an average of 92,413 long tons, valued at $853,627.

The United States has, therefore, in the interval named, produced about 13 per cent of the manganese ores which were consumed in the country.

Relative quantities and values of domestic and imported manganese ores from 1889 to 1901, inclusive.

Year.	Domestic production.		Imports.	
	Quantity.	Value.	Quantity.	Value.
	Long tons.		*Long tons.*	
1889	24,197	$240,559	4,286	$78,391
1890	25,684	219,050	34,154	516,900
1891	23,416	239,129	28,825	380,618
1892	13,613	129,586	58,572	840,811
1893	7,718	66,614	68,113	880,238
1894	6,308	53,635	44,655	432,561
1895	9,547	71,769	86,111	747,910
1896	10,088	90,727	31,489	250,468
1897	11,108	95,505	119,961	1,023,824
1898	15,957	129,185	114,885	831,967
1899	9,935	82,278	188,349	1,584,528
1900	11,771	100,289	256,252	2,042,361
1901	11,995	116,722	165,722	1,486,573
Total for 13 years	181,337	1,635,048	1,201,374	11,097,150
Average for 13 years	13,949	125,773	92,413	853,627

PRODUCTION OF MANGANESE ORE IN FOREIGN COUNTRIES.

CANADA.

A small amount of manganese ore was obtained in 1901 in the provinces of Nova Scotia and New Brunswick. The amount produced is not yet obtainable, but the exports of ore in the year 1901 were 440 short tons, valued at $4,820.

The production in Canada from 1886 to 1900, inclusive, together with the total value and average value per ton, also the exports by provinces from 1873 to 1901, inclusive, and the value of the exportations, are given in the following tables, furnished by the Canadian geological survey:

Production of manganese ore in Canada from 1886 to 1900.

Year.	Quantity.	Value.	Value per ton.
	Short tons.		
1886	1,789	$41,499	$23.20
1887	1,245	43,658	35.07
1888	1,801	47,944	26.62
1889	1,455	32,737	22.50
1890	1,328	32,550	24.51
1891	255	6,694	26.25
1892	115	10,250	89.13
1893	213	14,578	68.44
1894	74	4,180	56.49
1895	125	8,464	67.71
1896[a]	123½	3,975	32.19
1897[a]	15¼	1,166	76.46
1898	50	1,600	32.00
1899[b]	1,581	20,004	12.66
1900[c]	30	1,800	60.00

[a] Exports.
[b] Nova Scotia mined 63 tons. New Brunswick's product was 1,518 tons.
[c] Nova Scotia mined 10 tons and New Brunswick 20 tons.

Exports of manganese ore from Canada, 1873 to 1901, inclusive.

Year.	Nova Scotia.		New Brunswick.		Total.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Short tons		*Short tons.*		*Short tons.*	
1873	....	....	1,031	$20,192	1,031	$20,192
1874	6	$12	776	16,961	782	16,973
1875	9	200	194	5,314	203	5,514
1876	21	723	391	7,316	412	8,039
1877	106	3,699	785	12,210	891	15,909
1878	106	4,889	520	5,971	626	10,860
1879	154	7,420	1,732	20,016	1,886	27,436
1880	79	3,090	2,100	31,707	2,179	34,797
1881	200	18,022	1,504	22,532	1,704	40,554
1882	123	11,520	771	14,227	894	25,747
1883	313	8,635	1,013	16,708	1,326	25,343
1884	134	11,054	469	9,035	603	20,089
1885	77	5,054	1,607	29,695	1,684	34,649
1886	[a] 441	854	1,377	27,484	[a] 1,818	58,338
1887	578	14,240	837	20,562	1,415	34,802
1888	87	5,759	1,094	16,073	1,181	21,832
1889	59	3,024	1,377	26,326	1,436	29,350
1890	177	2,583	1,729	34,248	1,906	36,831
1891	22	563	233	6,131	255	6,694
1892	84	6,180	59	2,025	143	8,205
1893	123	12,409	10	112	133	12,521
1894	11	720	45	2,400	56	3,120
1895	108	6,348	$\frac{3}{10}$	3	108$\frac{3}{10}$	6,351
1896	123½	3,975	....	....	123½	3,975
1897	15¼	1,166	....	....	15¼	1,166
1898	11	325	....	....	11	325
1899	67	2,328	3	82	70	2,410
1900 [b]	....	....	....	....	34	1,720
1901	....	....	....	....	440	4,820

[a] 250 tons should be more correctly classed under the heading of mineral pigments.

[b] Owing to changes in compiling customs returns, exports can no longer be given by provinces.

CUBA.

Manganese ore was mined in the year 1901 by two companies in the southeastern portion of Cuba, and was shipped from the port of Santiago de Cuba. The amount exported in the year 1901, most of which was sent to the United States, amounted to 25,183 long tons, being the maximum output for the island.

It is probable that Cuba will continue to be an important source of supply of manganese ores for use in the United States.

The following table gives the exports from the year 1888 to 1901, inclusive. The year 1901 shows the maximum annual product.

Exports of manganese ore from Santiago district, Cuba, from 1888 to 1901, inclusive.

Year.	Quantity.	Year.	Quantity.
	Tons.		*Tons.*
1888	1,942	1895	1,394
1889	704	1896	None.
1890	21,810	1897	None.
1891	21,987	1898	950
1892	18,751	1899	13,686
1893	10,640	1900	22,600
1894	....	1901	25,183

BRAZIL.

Mr. Joaquin G. Michaeli, Prof. H. Gorceix, Mr. Arthur Guimaraes, and Mr. J. Pandia Calogeras have published articles and reports on the manganese deposits of Gandarella, in the State of Minas Geraes, Brazil. From these most of the following information has been taken:

The Gandarella estate, about 35 miles north of Ouro Preto, occupies the lower levels of an extremely irregular valley, where the soil is much cut up, as though at some recent date it had suffered from an overwhelming flood. This small basin is separated from the Rio das Velhas by an extensive chain of hills running approximately north and south. Manganese was found here as veins of pyrolusite at Jacutinga, and blocks and pebbles of the same mineral in the beds of the Lignito and Maquine brooks. The larger blocks always have sharp edges, suggesting that they have not been long exposed to attrition by water.

The earlier surveys were carried out in the valley of the Lignito Brook, where the manganese is visible in greatest quantity. A small outcrop of manganese also occurs between the two lignite outcrops, and a little higher up another outcrop occurs, nearly at right angles to the water course. Experimental borings, made at distances of 15 feet, showed almost pure pyrolusite.

Farther up the stream another deposit of almost pure dioxide of manganese, associated with red marl, was located near the surface. A little higher up the valley the stream completely disappears, and it is impracticable to judge of the size of the deposit. It is clear that the action of water has separated the material from the accompanying marl, which is derived from the decomposition of the schists in which the manganese beds occur, associated with itabirite and limestone.

The deposits of manganese are visible in the beds of the brooks, and isolated blocks are found lying in the water course. The true deposits are prolonged on either side of the streams. In some places the manganese disappears entirely, being replaced by considerable beds of itabarite (a crystalline hematite). On the left bank is a considerable natural excavation, produced by the action of water. Here is a deposit of rounded masses of pyrolusite, about 26 inches thick, overlying a marl stratum 8 feet thick, which incloses blocks of the mineral.

Guided by these facts a second series of surveys was undertaken in the Maquine district. The first excavation was made at the point where the Lagoa Brook flows into the river. Although the ground was covered with brush, it was easy to find excellent samples of pyrolusite, still associated with red marl similar to that noticed in the Lignito district. An excavation much deeper than any of the preceding ones failed to show any trace of manganese, but later it was found that this excavation was made in a bed of alluvium. After abandoning this point and following the course of the Maquine to its confluence with the Lagoa Brook, another outcrop of pyrolusite was located. In the bed of the latter were found blocks of the same material. This stream, owing to the configuration of the country, is not subject to "spates" of flood water. The course of the Maquine being followed farther, the stream was found to divide, and in the right branch were indications of a deposit of pyrolusite, which is cut by the brook a little higher up, and at that point has a breadth of 65 feet, extending across the water course. In the left branch of the stream no indications are visible, as the abrasive action of the water has not exposed any existing beds. In the Maquine Valley pyrolusite is visible where not covered by a layer of marl.

Two large outcrops were located, the mineral of both having the same appearance and chemical composition. Both outcrops may form part of the same bed, although they are from 2 to 4 miles apart.

In the Moinho Valley similar indications of the presence of manganese were noted. On the road between the Bento and the Gandarella estates shallow excavations proved the existence of manganese ores, some pure, others containing various quantities of iron. Similar indications were found along the banks of the Gandarella, which is formed by the union of the Lignito and Maquine brooks. During the progress of this work, in localities where the soil is black, fine specimens of crystalline dioxide of manganese, also the compact variety, and manganiferous conglomerate were found, similar in all respects to those of the Lignito Valley.

It is evident that the Gandarella estate possesses manganese deposits which may be available for exploitation after a road is constructed to the Rio Acima station, on the Central Railroad of Brazil.

The chemical composition is shown in the following analyses, made at the School of Mines, Ouro Preto:

Analyses of manganese from the Gandarella estate, Minas Geraes, Brazil.

Constituent.	1.	2.	3.	4.	5.	6.
Volatile matter	1.00	1.00	1.50	1.75	1.95	2.00
Insoluble matter	1.14	.50	1.50	.45	1.74	1.65
Manganese dioxide	92.31	87.27	78.94	78.93	89.76	90.79
Phosphorus	Traces.	Traces.	Traces.	Traces.	Traces.	Traces.
Sulphur	Traces.	Traces.	Nil.	Traces.	Nil.	Nil.
Magnesia	Traces.	Traces.	Nil.	Traces.	Nil.	.00
Lime	.20	1.23	Nil.	1.41	1.50	.90
Iron oxide and alum	6.50	10.50	18.60	18.12	8.12	7.00
Metallic manganese	58.36	55.48	49.90	49.35	56.74	57.30

1. From the outcrop in the lower portion of the bed of Lignito Brook.
2. From the same stream.
3. From the Maquine Brook.
4. From confluence of Lagoa and Maquine brooks.
5. From a bed 26 inches thick on left bank of Lignito Brook.
6. Mineral found in Lignito and Maquine valleys.

Mr. Herbert Kilburn Scott, of Rio de Janeiro, Brazil, states that during the year 1899 the manganese ore industry increased in importance in the State of Minas Geraes, the two principal firms engaged in this business mining between them about 75,000 tons, though the exports to consuming countries were somewhat less, owing to the high freights ruling at that time.

This expansion continued during the early part of 1900, but toward the close a sharp rise in the gold value of the national currency and a fall in the selling price of the mineral caused a partial suspension of work, which continued till the middle of the year 1901.

Regular work was gradually resumed, and although the economic conditions are not now so favorable as in 1899, it may be said that the quantity of ore mined will gradually increase. The principal firms engaged in this industry, with the location of their mines and the average analyses of their cargoes as reported, are:

Names of firms, locations of mines, and average analyses of cargoes dried at 100° C.

Firm.	Location of mine.	Metallic manganese.	Phosphorus.	Silica.	Moisture.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*
Usina Wigg	Miguel Buriner	50 to 54	0.01 to 0.03	1 to 2	15 to 20
Goncaloes Ramos & Co., late Airosa & Co.	Miguel Buriner	47 51	.02 .01	1 2	15 20
	Piquiry	49 51	.08 .10	5 7	3 5
Société des Mines de Manganese de Ouro Preto.	Sao Goncalo	50 52	.12 15	1 2	3 5
Companhia de Morro da Mina	Morro da Mina[a]				

[a] No cargoes shipped, about the same quality as Piquiry.

The firms of Usina Wigg and Goncaloes Ramos & Co. (late Airosa & Co.) have been working manganese mines for some years, but the Société des Mines de Manganese de Ouro Preto and that of the Morro da Mina have been mining only for a relatively short time.

The Ouro Preto Company commenced operations near the city of that name in 1899, but owing to difficulty in finding a satisfactory deposit of ore the company acquired the Sao Goncalo property, situated 8 miles from the Central Railway station of Lafayette and 3 miles from the Piquiry deposit of Goncaloes Ramos & Co. The ore body was found to be of importance, and quantities of mineral were quarried before the end of 1900, which, however, could not be exported until 1901, owing to the noncompletion of the narrow-gage railway to connect the mine with the Central Railway.

The Morro da Mina Company has not yet commenced exporting ore, though quantities have been mined. The ore body is reported to be about 3 miles from the station of Lafayette, and a narrow-gage line is being laid to connect with the Central Railway.

Only a relatively small quantity of ore has been shipped from the state of Bahia during the last two years owing to unfavorable economic conditions.

EXPORTS OF BRAZILIAN MANGANESE ORE.

The exports of manganese ores from Brazil to various foreign countries from 1896 to the close of the year 1901 are as follows:

Exports of Brazilian manganese ore, 1896 to 1901, inclusive.

Year.	Quantity.	Year.	Quantity.
	Long tons.		*Long tons.*
1896	14,710	1899	62,170
1897	14,370	1900	[a] 127,348
1898	27,110	1901	[b] 95,710

[a] Europe, 75,910; United States, 51,438.

[b] Europe, 47,680; United States, 48,030.

Owing to the high percentage of moisture in the greater portion of the Usina Wigg ore, steps are being taken to calcine and briquette it.

COLOMBIA.

There are some manganese mines located in the Nombre de Dios district, on the Isthmus of Panama, not far from the Caribbean Sea, that have heretofore supplied considerable ore, most of it being shipped to the United States.

The principal mining operation reported that in the year 1901 but one cargo of 684 tons was shipped.

The shipments of manganese ore, as reported to this office, from 1896 to 1901, inclusive, are given in the accompanying table:

Shipments of manganese ore from Colombia.

Calendar year.	Quantity.
	Long tons.
1896	18,215
1897	(a)
1898	8,595
1899	8,955
1900	8,610
1901	684

[a] Not reported.

CHILE.

Mr. C. Vattier, in a monograph entitled "Notes on the Condition of Chile for the Installation of Iron Metallurgy," gives an interesting description of the manganese ores of that country. He says:

> Manganese ores are found in nearly every part of the Republic. The Corral Quemado mines (Department of Ovalle) and those of Naranjo (Elqui) have been developed on a large scale.
>
> The Coquimbana and the Negra mines are worked in the province of Atacama, near Canto de Agua, and in the Department of Vallenar other mines could be opened.
>
> In the province of Santiago the manganese deposit of Hospital has been worked for some years, and several other deposits have been recently discovered.
>
> Some deposits of oxide of manganese have been exploited in the Departments of Illapel and Combarbala, such as those of Huintil.
>
> In San Felipe (province of Aconcagua), as well as in the province of Coquimbo, important deposits have been discovered.
>
> To the south of Huasco, in the Los Chorros district, deposits of manganese have been found that promise a good future, when the railroad between Serena and Vallenar is completed.
>
> There are some important deposits in the south near Corral and Valdivia.
>
> The manganese ores are reported in various geological horizons, especially in the secondary formations with stratified schist, red and yellow sandstone, and with eruptions of porphyritic rocks. The superficial deposits with a thickness of from 12 to 15 meters, such as those of Elqui and of the Negra mine, which degenerate into hydrated red oxide of iron in the Department of Freirina, must be distinguished from the real lodes found at a great depth, such as those of the Coquimbana (Freirina), the Corral Quemado (Ovalle), etc., which have a thickness varying from a meter to a meter and a half, or more.

The ores which are exported to Europe and the United States yield from 49 to 53 per cent metallic manganese.

Nearly all the manganese ore produced is exported, and the yearly amounts sent away from 1885 to 1901 are as follows:

Exports of Chilean manganese ores, 1885 to 1901, inclusive.

Year.	Quantity.	Value.
	Long tons.	
1885	4,041	....
1886	23,928	....
1887	47,521	....
1888	18,713	....
1889	28,683	....
1890	47,986	....
1891	34,462	....
1892	50,871	$399,881
1893	36,162	284,262
1894	47,238	$371,374
1895	23,696	186,747
1896	25,740	202,335
1897	23,156	....
1898	20,522	163,165
1899	40,285	448,195
1900	25,319	....
1901	31,477	....

GREAT BRITAIN.

There is a limited amount of manganiferous iron ore mined in Great Britain, but no true manganese ore is won. The production in 1900 was 1,362 long tons, valued at £675,[a] or $3,285.

The following table indicates the quantities and values of manganiferous iron ore obtained in Great Britain from 1884 to 1900, inclusive:

Production and value of manganiferous iron ores in the United Kingdom from 1884 to 1900.

Year.	Quantity.	Value.
	Long tons.	
1884	909	$6,921
1885	1,688	11,669
1886	12,763	52,722
1887	13,777	53,772
1888	4,342	9,361
1889	8,852	31,354
1890	12,444	32,588
1891	9,476	30,071
1892	6,078	21,461
1893	1,336	$3,688
1894	1,809	3,582
1895	1,273	3,323
1896	1,080	2,983
1897	599	[a] 1,650
1898	231	974
1899	415	1,212
1900	1,362	3,285

[a] Estimated.

FRANCE.

M. Alexandre Pourcel has furnished data in reference to the production of manganese ore in France in the year 1900. He reports that manganese ores were produced from 10 mines in two departments—in the south of L'Ariège, and in the eastern and central sections of Saone and Loire. In the year 1900 three mines were operated in the Department of L'Ariège, viz, Las Cabesses, Cazalas, and Brachy, producing about 12,000 tons of carbonate of manganese, as against 29,000 tons in the year 1899. Of this amount 10,000 metric tons were calcined and 2,000 tons were assorted carbonate. The number of employees operating the mines in 1899 was 415, but at the commencement of the year 1900 there were 230 and at the end only 60. At the Romanèche mines, and at two mines on the Grand Filon, in Saone and Loire, there were extracted 9,820 tons of binoxide of manganese, as against 9,000 tons in the year 1899. The value of the total production of 29,000 metric tons, or 28,534 long tons, was 850,000 francs, or $164,050, making the valuation per ton $5.75. The annual production and value of the manganese ores mined in France from 1886 to 1900, inclusive, were as follows:

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[a] £ is taken at $4.8665.

Production and value of manganese ores in France from 1886 to 1900, inclusive.

Year.	Quantity.	Value.	Value per ton.
	Long tons.		
1886	7,555	$53,099	$7.03
1887	11,932	50,501	4.23
1888	10,873	60,757	5.59
1889	9,842	59,000	5.99
1890	15,731	89,517	5.69
1891	15,101	90,316	5.98
1892	31,894	205,074	6.43
1893	37,406	290,073	7.75
1894	32,239	$192,264	$5.96
1895	30,385	177,698	5.85
1896	30,797	179,297	5.82
1897	36,612	200,720	5.48
1898	31,396	160,383	5.11
1899	39,270	215,581	5.49
1900	28,534	164,050	5.75

BELGIUM.

The production of manganiferous iron ore in Belgium in the year 1900 was 10,820 metric tons, valued at 130,350 francs,[a] or $25,158.

The table below will show the amounts and values of the manganiferous iron ores mined in Belgium from 1880 to 1900, inclusive.

Production of manganiferous iron ores in Belgium from 1880 to 1900, inclusive.

Year.	Quantity.	Value.
	Metric tons.	
1880	700	$772
1881	770	772
1882	345	338
1883	820	791
1884	750	724
1885	....	....
1886	750	1,737
1887	12,750	30,079
1888	27,787	62,725
1889	20,905	47,864
1890	14,255	33,968
1891	18,498	$49,022
1892	16,775	40,202
1893	16,800	38,793
1894	22,048	53,596
1895	22,478	55,250
1896	23,265	66,589
1897	28,372	66,141
1898	16,440	40,820
1899	12,120	30,245
1900	10,820	25,158

---

[a] Franc taken at 19.3 cents.

GERMANY.

The manganese ores produced in Germany are more properly classed as manganiferous iron ores, the greater portion, 57,100 long tons in 1900, coming from the Kingdom of Prussia. Of the remainder, 745 tons came from Saxe-Coburg-Gotha and 424 tons were scattering, a total for the Empire of 58,269 long tons, valued at about $3 per ton.

The production and value of manganese ores mined in Prussia from 1881 to 1900, and in Germany from 1890 to 1900, were as follows, those for the last-named year being furnished by Dr. Herman Wedding:

Production and value of manganese ores in Prussia from 1881 to 1900, inclusive.

Year.	Quantity.	Value.	Year.	Quantity.	Value.
	Long tons.			*Long tons.*	
1881	10,911	$79,104	1891	36,278	$174,624
1882	4,597	33,745	1892	30,892	101,844
1883	4,502	28,423	1893	38,381	93,506
1884	7,629	43,118	1894	41,854	91,992
1885	14,464	81,302	1895	39,266	100,832
1886	24,649	177,066	1896	42,925	97,469
1887	35,957	228,439	1897	41,538	98,185
1888	26,877	147,250	1898	41,565	92,050
1889	43,311	216,381	1899	59,425	151,368
1890	39,497	174,428	1900	57,100	157,271

Production of manganese ores in Germany from 1890 to 1900, inclusive.

Year.	Quantity.	Year.	Quantity.
	Long tons.		*Long tons.*
1890	41,180	1896	44,350
1891	39,698	1897	45,694
1892	32,341	1898	42,669
1893	40,057	1899	60,360
1894	43,012	1900	58,269
1895	40,674		

ITALY.

The Kingdom of Italy has a limited output of manganese ore, 6,014 metric tons, valued at 154,974 lire [a], being obtained in 1900. In addition, 26,800 metric tons of manganiferous iron ore, valued at 335,000 lire, were mined.

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[a] The lira is taken at 19.3 cents.

The production and valuation of manganese and manganiferous iron ores in Italy from 1860 to 1900, inclusive, are given in the following table:

Production of manganese and manganiferous iron ores in Italy from 1860 to 1900, inclusive.

Year.	Manganese ores.		Manganiferous iron ores.	
	Quantity.	Value.	Quantity.	Value.
	Long tons.		*Long tons.*	
1860	642	$12,373	....	....
1861	515	9,174	....	....
1862	1,714	15,661	....	....
1863	714	6,674	....	....
1864	712	8,567	....	....
1865	571	6,716	....	....
1866	711	7,191	....	....
1867	677	8,079	....	....
1868	661	7,894	....	....
1869	758	10,403	....	....
1870	630	8,646	....	....
1871	779	9,793	....	....
1872	1,125	12,311	....	....
1873	3,103	46,548	....	....
1874	3,169	58,697	3,445	$6,755
1875	3,750	64,341	19,684	96,500
1876	6,800	61,074	22,878	93,315
1877	6,704	56,546	7,874	26,248
1878	6,550	46,567	6,368	15,297
1879	5,614	33,842	1,366	2,679
1880	6,373	40,682	20,148	63,214
1881	8,629	45,219	[a] 29,526	[a] 92,640
1882	6,868	67,201	[a] 29,526	[a] 92,640
1883	11,204	52,975	8,858	27,792
1884	871	7,570	....	....
1885	1,774	10,899	....	....
1886	5,473	30,943	....	....
1887	4,363	21,872	....	....
1888	3,573	15,054	....	....
1889	2,168	9,998	....	....
1890	2,113	10,050	....	....
1891	2,391	12,467	....	....
1892	1,223	8,067	4,549	8,028
1893	797	6,320	8,666	14,445
1894	748	4,536	5,718	8,971
1895	1,544	13,634	....	....
1896	1,860	19,734	9,842	19,300
1897	1,608	14,483	20,926	32,829
1898	2,955	18,052	10,974	25,823
1899	4,287	21,647	29,402	74,449
1900	5,919	29,910	26,377	64,655

[a] In original, 30,000 metric tons, valued at 480,000 lire, possibly an estimate.

SPAIN.

The greater portion of the manganese ores mined in Spain are of the carbonate and silicate varieties, obtained from the province of Huelva. A small amount of oxide of manganese is occasionally mined in the provinces of Oviedo and Teruel. Mr. Carl Doetsch has supplied statistics in regard to the manganese ore mined in Spain in the year ending December 31, 1901, together with the countries to which it was exported, to which have been appended similar data for the years 1899 and 1900, as follows:

Exports of Huelva manganese ores in 1899, 1900, and 1901.

Country.	Quantity.		
	1899.	1900.	1901.
	Metric tons.	*Metric tons.*	*Metric tons.*
Belgium and Luxemburg	127,743	126,482	85,951
England	4,842	1,213	918
France	4,449	2,221	2,361
Germany	1,385	....	2,442
Total	138,419	129,916	91,672

From this it will be seen that the larger amount of ore is sent to Belgium and Luxemburg, where it is reported to be valuable as a mixture with the local "minette" ores.

The production of manganese ores in Spain from 1890 to 1901, inclusive, is as follows:

Production of manganese ores in Spain from 1890 to 1901, inclusive.

Year.	Quantity.	Year.	Quantity.
	Long tons.		*Long tons.*
1890	9,716	1896	90,546
1891	6,883	1897	101,937
1892	16,643	1898	136,182
1893	1,437	1899	136,533
1894	423	1900	127,864
1895	26,946	1901	[a] 90,224

[a] Province of Huelva only.

PORTUGAL.

Mr. J. H. Thieriot, United States consul at Lisbon, has furnished some interesting data in regard to the manganese mines of Portugal.

The largest and best of the mines producing oxide of manganese are Ferragudo, Serra dos Feitaes, Herdade do Valle Calvo, Cabess do Moinho, Albornoa, Santa Victoria, Aljustrel, and Alcaria Ruiva (Mertola), all situated in the district of Beja, province of Alemtejo. In many of these mines carbonate of manganese lodes occur, being especially large in Ferragudo mine.

The Lagoas de Paco mine, in Ferreira, district of Beja, produces carbonate of manganese yielding 34 per cent of metallic manganese.

Analyses of manganese ore from the Alonso Gomes mines, Portugal.

Constituent.	1.	2.	3.	4.	5.	6.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Binoxide of manganese	72.56	76.75	72.21	80.86	71.88	....
Siliceous matter	4.71	6.58	4.75	2.78	1.62	8.98
Metallic iron	2.14	2.34	2.03	2.27	3.59	3.27
Metallic manganese	55.20	54.88	54.65	59.73	51.03	53.84
Phosphorus	.03	.04	....	.04	....	....

Carbonate of manganese:	Per cent.
Siliceous matter	8.50
Metallic iron	2.25
Metallic manganese	48.25
Phosphorus	.05

The production in Portugal in 1900 shows that 1,972 metric tons were mined, valued at 9,664,895 reis, or $10,438.

AUSTRIA-HUNGARY.

The reported production of manganese ore in Austria in 1900 was 8,804 metric tons, valued at 136,948 crowns, or $27,800, equivalent to $3.16 per ton.

The annexed table shows the amounts of manganese ore mined yearly from 1876 to 1900, inclusive:

Production of manganese ore in Austria from 1876 to 1900, inclusive.

Year.	Quantity.	Year.	Quantity.
	Centners.		*Centners.*
1876	67,817	1889	39,261
1877	78,999	1890	80,068
1878	41,836	1891	52,793
1879	34,337	1892	46,000
1880	88,744	1893	54,000
1881	91,097	1894	101,120
1882	84,183	1895	[a] 92,270
1883	93,821		*Metric tons.*
1884	79,423	1897	6,012
1885	61,577	1898	6,132
1886	92,464	1899	5,411
1887	93,108	1900	8,804
1888	65,541		

[a] Including Bosnia.

The Kingdom of Hungary mined 5,746 metric tons in 1900, and Bosnia and Herzegovina are credited with 7,938 metric tons in the same year.

The following tables show the production of manganese ore in Hungary from 1897 to 1900, inclusive, and in Bosnia and Herzegovina from 1892 to 1900, inclusive:

Production of manganese ore in Hungary.[a]

Year.	Quantity.
	Metric tons.
1897	3,976
1898	8,055
1899	5,073
1900	5,746

[a] Ungarisches Statistiches Jahrbuch.

Production of manganese ore in Bosnia and Herzegovina.

Year.	Quantity.
	Long tons.
1892	7,819
1895	8,016
1896	6,713
1897	[a]5,260
1898	[a]5,235
1899	5,536
1900	7,813

[a] Bosniches Bureau Montan Abtheilung.

SWEDEN.

Sweden has been a producer of small amounts of manganese ore, the product in the year 1900, according to the official Swedish statistics, being 2,609 tons, valued at $13,179, or $5.05 per ton. Dr. Richard Åkerman reports that in 1901 there were mined 2,235 tons, valued at $11,256, or $5.03 per ton. The production of manganese ore in Sweden from 1888 to 1901 is given in the following table, together with the values from 1896 to 1901, inclusive:

Production of manganese ore in Sweden, 1888 to 1901, inclusive.

Year.	Quantity.	Value.	Year.	Quantity.	Value.
	Long tons.			*Long tons.*	
1888	9,537	....	1895	3,068	....
1889	8,509	....	1896	2,023	$7,197
1890	10,529	....	1897	2,706	12,616
1891	8,936	....	1898	2,321	11,060
1892	7,708	....	1899	2,581	11,990
1893	6,949	....	1900	2,609	13,179
1894	3,306	....	1901	2,235	11,256

RUSSIAN EMPIRE.

The Russian Empire is the largest contributor of manganese ores, one-half of the world's output being credited to that country.

The greatest portion of this ore comes from the Caucasus district, followed in order by South Russia and the Ural districts. A detailed description of the first-mentioned district was given in the report for 1897. A reduction, in 1899, of the high freight rate charged by the Russian Government for the haul from Chiaturi to Sharopan, together with good prices and a brisk demand, resulted in the maximum output for the district in 1899, later figures not being obtainable.

The major portion of the manganese ore obtained in the Caucasus district is exported. The table below, furnished by the Hon. Charlemagne Tower, United States ambassador, gives the distribution of these exportations by countries:

Distribution of exports from Caucasus (in poods).

Country to which exported.	1893.	1894.	1895.	1896.	1897.	1898.	1899.
Great Britain....	2,623,577	4,169,880	3,796,270	4,715,355	3,787,700	4,975,892	8,502,306
Belgium.........	161,540	128,440	118,900	13,200	89,400	260,000	54,900
Germany........	294,023	367,230	435,400	398,540	575,297	570,932	888,200
Holland.........	2,187,500	2,514,984	3,144,020	3,110,690	3,743,915	5,598,896	8,037,346
France..........	261,215	....	....	343,560	3,695	307,071	439,379
Austria..........	....	....	....	....	....	142,663	....
United States....	2,105,590	1,779,960	2,676,880	226,300	2,700,659	2,754,633	5,926,841
Russia...........	6,705	639,066	468,248	1,259,808	1,612,770	1,901,149	2,662,860
Total......	7,640,150	9,599,560	10,639,718	10,067,453	12,513,436	16,511,236	26,511,832

Mr. Tower has also supplied a table showing the production of the Russian Empire by districts, together with the exports from 1885 to 1899, inclusive.

Statistics of manganese ores in Russia (in poods).[a]

Year.	Production.				Exports.	
	Ural.	Southern Russia.	Caucasus.	Total.	Caucasus.[b]	Total.
1885......	54,700	....	3,640,800	3,695,500	2,567,000	2,567,000
1886......	50,000	250,000	4,242,100	4,542,100	3,403,000	3,403,000
1887......	50,000	226,350	3,277,200	3,353,550	3,690,000	3,690,000
1888......	82,700	89,600	1,822,800	1,995,100	3,055,000	3,055,000
1889......	179,100	341,500	4,243,200	4,763,800	3,237,000	3,237,000
1890......	143,500	528,100	10,468,100	11,139,700	8,235,000	8,235,000
1891......	118,000	660,000	6,126,000	6,904,000	4,575,000	4,575,000
1892......	56,000	1,795,000	10,560,000	12,411,000	7,876,000	7,876,000
1893......	186,000	4,740,000	11,673,000	16,599,000	7,633,000	7,656,000
1894......	108,000	3,562,000	11,193,000	14,863,000	8,961,000	8,965,000
1895......	168,000	2,287,000	9,943,000	12,398,000	10,172,000	10,172,000
1896......	255,000	2,782,000	9,662,000	12,699,000	8,808,000	8,842,000
1897......	303,000	3,417,000	12,343,000	16,063,000	10,900,000	11,441,000
1898......	396,000	3,640,000	16,066,000	20,102,000	14,610,000	14,950,000
1899......	111,000	5,919,000	34,077,000	40,107,000	23,849,000	25,336,000

[a] One long ton equals 62 poods.

[b] Exports in Russia not included.

The pood is equal to 36.112 pounds, which would make the total production in Russia, in 1899, 646,582 long tons.

TURKEY.

Manganese ore exists in Macedonia and Asia Minor, and the exports from Salonica in 1900, according to the British Consular Report, were 38,100 tons.

GREECE.

The production of manganese ore in Greece in 1900 was 8,050 metric tons, valued at $45,170, and in 1901 a production of 14,166 metric tons, valued at $52,610, was reported.

JAVA.

Some manganese deposits exist in the regencies of Pengasih and Mangoelan, 4,800 tons being reported as obtained in 1898 and 1,388 tons in 1899.

INDIA.

This country has shown a decided increase in the production of manganese ore, practically all of which comes from the presidency of Madras.

The secretary of the revenue and statistics department of the India office gives the production of manganese ore in 1900 as 130,670 tons, nearly twelve times as much as was reported in 1894.

The greater portion of this ore is shipped to Great Britain, 11,000 tons coming to the United States.

The following table gives the exports or production for the years 1894 to 1900, inclusive:

Exports of manganese ore from British India by sea to other countries from 1894 to 1900 inclusive.

Year.	Quantity.	Year.	Quantity.
	Long tons.		*Long tons.*
1894	11,410	1898[a]	60,449
1895	15,816	1899[a]	87,126
1896	56,869	1900[a]	130,670
1897	73,680		

[a] Production.

JAPAN.

Most, if not all, of the manganese ores mined in Japan are exported, and, according to the annual returns of the foreign trade of the Empire of Japan (department of finance), 14,921,197 kin[a] (8,726 long tons), valued at 187,177 yen[b] ($93,214), were exported in 1901. The value averaged $10.56 per ton.

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[a] Kin taken at 1.31 pounds.

[b] Yen equals 49.8 cents.

The table below will show the annual exports of manganese ore from 1881 to 1901, inclusive, also the value of the same from 1893 to 1901:

Exports of manganese ores from Japan, 1881 to 1901, inclusive.[a]

Year.	Quantity.	Value.	Year.	Quantity.	Value.
	Long tons.			*Long tons.*	
1881	2	....	1892	4,948	....
1882	156	....	1893	18,510	$106,016
1883	151	....	1894	17,465	99,007
1884	125	....	1895	16,338	97,906
1885	123	....	1896	20,785	136,668
1886	404	....	1897	14,524	102,248
1887	312	....	1898	9,905	77,853
1888	813	....	1899	9,157	76,039
1889	945	....	1900	12,576	111,750
1890	2,604	....	1901	8,726	93,214
1891	3,178	....			

[a] Reports Department of Finance, Empire of Japan.

AUSTRALIA.

QUEENSLAND.

Queensland mined each year small amounts of manganese ore, the amount obtained in 1900 being 75 long tons, valued at £205, or $998.

The table below gives the production and valuation of the manganese ores obtained from 1881 to 1884, and from 1889 to 1900, inclusive:

Production and value of manganese ores in Queensland from 1881 to 1884 and from 1889 to 1900, inclusive.

Year.	Quantity.	Value.	Year.	Quantity.	Value.
	Long tons.			*Long tons.*	
1881	87	$1,263	1893	....	....
1882	100	1,694	1894	140	$1,936
1883	20	290	1895	355	5,387
1884	55	799	1896	300	4,380
1889	4	87	1897	300	5,475
1890	5	97	1898	67	1,221
1891	10	126	1899	735	13,775
1892	....	....	1900	75	998

NEW SOUTH WALES.

Mr. Joseph E. Carne reported that 12 tons of manganese ore were mined in New South Wales in the year 1901.

NEW ZEALAND.

This island contributes small amounts of manganese ores, 135 tons, valued at $1,980, being obtained in 1899, and 166 tons, valued at £588, or, $2,862 in 1900.

WORLD'S PRODUCTION OF MANGANESE ORES.

It is difficult to secure late data in regard to the production of manganese ores in various foreign countries, but in the accompanying table the latest figures obtainable are given, together with the year of record.

The tons are either long or metric, except in Canada, where the short ton is used. No statistics in regard to manganiferous iron ores are included.

World's production of manganese ores.

Country.	Year.	Production.	Country.	Year.	Production.
North America:			Europe—Continued.		
United States	1901	11,995	Portugal	1900	1,972
Canada[a]	1901	440	Russia	1899	646,582
Cuba[a]	1901	25,183	Spain	1901	91,672
South America:			Sweden	1901	2,235
Brazil[a]	1901	95,710	Turkey (exported from Salonica)	1900	38,100
Colombia[a]	1901	684	Asia:		
Chile[a]	1901	31,477	India	1900	130,670
Europe:			Japan	1901	8,726
Austria	1900	8,804	Java	1899	1,388
Bosnia and Herzegovinia	1900	7,813	Oceania:		
Hungary	1900	5,746	New South Wales	1901	12
France	1900	21,574	Queensland	1900	75
Germany	1900	58,269	New Zealand	1900	166
Greece	1901	14,166			
Italy	1900	5,919			

[a] Exports.

The important producers according to rank are Russia, India, Brazil, Spain, Germany, Turkey, Chile, and Cuba.

ACKNOWLEDGMENTS.

In the text an effort has been made to credit various correspondents with detailed information supplied by them, but many general statements obtained from other correspondents have not been duly credited. It is also eminently proper to recognize the valuable aid rendered by Mr. F. L. Bitler in compiling the data for this report.

COPPER.

By Charles Kirchhoff.

GENERAL TRADE CONDITIONS.

The conditions surrounding the copper-mining industry during the year 1901 were in many respects extraordinary. Production was only slightly less than it had been in 1899 and in 1900, and consumption in this country was undoubtedly considerably greater. But a determined effort was made during the greater part of the year to maintain values in the face of adverse conditions in the countries which are the principal customers for our large surplus. Prices were kept above the parity of Europe, so that large importations were added to the supply. The result was an extraordinary accumulation of the red metal in the hands of leading interests. For a while cooperation between the principal producers was tried, and, when this failed, coercion was attempted by the breaking of the market toward the close of the year. This was preceded by a very serious decline in the shares of copper companies on both sides of the Atlantic.

The course of events has left the industry in a weakened condition.

Many copper-mining enterprises which were started during the period of high values are beginning to fall into line as producers or are rapidly reaching the point when they will become contributors to the market for the metal. Those whose preparations continued during 1901 were too few in number, or were too small, or entered the ranks of producers too late notably to affect the output of 1901. But, taken in the aggregate, these companies and those that will fall into line in 1902 will make a notable increase in the production certain. Then, too, some of the older mines have increased their capacity and are likely to follow the policy, during times of narrow margins of profit, of endeavoring to crowd down costs by at least distributing general expenses and fixed charges over a larger tonnage, particularly since there is little hope in the principal districts of lowering costs of production in other directions.

With the general advance in prices of nearly all manufactured products in the United States, supplies are a larger item than they were at a former period when the cost of production of copper was at a minimum. Mine labor and labor generally is so well employed in those copper districts which are not controlled by unions that any attempt to reduce wages must result in a prompt desertion of the most effective men. Besides, the fact is recognized that the higher cost of living must make a return to former scales of wages impossible for some time to come.

It is certain, therefore, that costs of production, which have risen considerably in recent years, can recede only gradually, and are not likely, for some time to come, to approach the low limits reached some years ago.

On the other hand, it will not do to expect any serious restriction in the output as the result of the sharp decline in the price which took place during the closing weeks of 1901. It is the experience of former periods of depression in copper mining that a long time elapses before even the weaker mines, whose costs range above the selling price, are forced to suspend production. Expensive development work is suspended, reserves are exhausted, and assessments are levied, before the hope is abandoned that the enterprise can be kept alive. Besides, in the copper-mining industry in the United States by far the greatest part of the product is furnished by a comparatively small number of large mines, which can make ends meet at pretty low selling prices.

The prospects for improvement must rest chiefly upon the stimulation of the demand which must follow low values of what is a very important industrial metal. There is ample proof that this has told since the collapse of prices, as it has done in the past under similar circumstances. Since the days of the Secretan bubble one highly important element has assumed first rank in importance in the shaping of copper consumption, and that is the demand for electrical purposes. Let it be granted that the use of high-tension currents has very seriously cut down the requirements of copper for an individual installation—and that is a feature which students of the copper industry have been inclined to underrate—let it be granted that this is an adverse influence of the first importance, yet the intense activity in the electrical field and the apparently undoubted opportunities for further development justify the expectation that the quantities of the metal which will be absorbed in electrical enterprises all over the world will grow rapidly and continuously.

PRODUCTION.

The following table shows the production of copper in the United States since its rise to the dignity of an industry. For the earlier years the best available sources have been drawn upon for the estimates given. Since 1882 the figures are those collected by this office.

Production of copper in the United States from 1845 to 1901, inclusive.

[Long tons.]

Year.	Total production.	Lake Superior.	Percentage of Lake Superior of total product.
1845	100	12	12
1846	150	26	17.3
1847	300	213	71
1848	500	461	92.2
1849	700	672	96
1850	650	572	88
1851	900	779	86.6
1852	1,100	792	72
1853	2,000	1,297	64.9
1854	2,250	1,819	80.8
1855	3,000	2,593	86.4
1856	4,000	3,666	91.7
1857	4,800	4,255	88.6
1858	5,500	4,088	74.3
1859	6,300	3,985	63.3
1860	7,200	5,388	74.8
1861	7,500	6,713	89.5
1862	9,000	6,065	67.4
1863	8,500	5,797	68.2
1864	8,000	5,576	69.7
1865	8,500	6,410	75.4
1866	8,900	6,138	69
1867	10,000	7,824	78.2
1868	11,600	9,346	80.6
1869	12,500	11,886	95.1
1870	12,600	10,992	87.2
1871	13,000	11,942	91.9
1872	12,500	10,961	87.7
1873	15,500	13,433	86.7
1874	17,500	15,327	87.6
1875	18,000	16,089	89.4
1876	19,000	17,085	89.9
1877	21,000	17,422	83
1878	21,500	17,719	82.4
1879	23,000	19,129	83.2
1880	27,000	22,204	82.2

Year.	Total production, United States.	Lake Superior.	Percentage of Lake Superior of total product.	Montana.	Percentage of Montana of total product.	Arizona.	Percentage of Arizona of total product.
1881	32,000	24,363	76.1	....	....	....	....
1882	40,467	25,439	62.9	....	....	....	....
1883	51,574	26,653	51.6	11,011	21.3	10,658	20.7
1884	64,708	30,961	47.8	19,256	29.8	11,935	18.4
1885	74,052	32,209	43.5	30,267	40.9	10,137	13.7
1886	70,430	36,124	51.3	25,362	36	6,990	9.9
1887	81,017	33,941	41.9	35,133	43.4	7,910	9.7
1888	101,054	38,604	38.2	43,704	43.2	14,195	14
1889	101,239	39,364	38.7	43,849	43.3	13,654	13.5
1890	115,966	45,273	38.9	50,437	43.5	15,534	13.4

Production of copper in the United States from 1845 to 1901, inclusive—Continued.

[Long tons.]

Year.	Total production, United States.	Lake Superior.	Percentage of Lake Superior of total product.	Montana.	Percentage of Montana of total product.	Arizona.	Percentage of Arizona of total product.
1891	126,839	50,992	40.2	50,028	39.5	17,800	14
1892	154,018	54,999	35.7	72,860	47.3	17,160	11.1
1893	147,033	50,270	34.2	69,290	47.1	19,200	13.1
1894	158,120	51,031	32.3	81,729	51.6	19,873	12.6
1895	169,917	57,737	34	84,900	50	21,408	12.6
1896	205,384	64,073	31.2	99,071	48.2	32,560	15.8
1897	220,571	64,858	29.4	102,807	46.6	36,398	16.5
1898	235,050	66,291	28.2	92,041	39.2	49,624	21.1
1899	253,870	65,803	25.9	100,503	39.6	59,399	23.4
1900	270,588	64,938	24	120,865	44.7	52,820	19.5
1901	268,782	69,772	25.9	102,621	38.2	58,383	21.7

Previous volumes of the Mineral Resources contain a detailed statement of the copper production of the United States, territorially, from 1883, when the statistics were first collected by this office, to 1892. Since then the production has been as follows:

Total copper production in the United States from 1892 to 1901, inclusive.

[Pounds.]

Source.	1892.	1893.	1894.	1895.	1896.
Lake Superior	123,198,460	112,605,078	114,308,870	129,330,749	143,524,069
Arizona	38,436,099	43,902,824	44,514,894	47,953,553	72,934,927
Montana	163,206,128	155,209,133	183,072,756	190,172,150	221,918 179
New Mexico	1,188,796	280,742	31,884	143,719	2,701,664
California	2,980,944	239,682	120,000	218,332	690,237
Utah	2,209,428	1,135,330	1,147,570	2,184,708	3,502,012
Colorado, including copper smelters [a]	7,593,674	7,695,826	6,481,413	6,079,243	6,022,176
Nevada	....	20,000	....	....	....
Idaho	226,000	36,367	....	1,425,914	....
Washington	....	39,785	....	....	....
Maine and New Hampshire Vermont Southern States Middle States	467,448	732,793	2,374,514	3,105,036	4,704,993
Lead desilverizers, etc. [b]	5,491,702	7,456,838	2,136,473	....	4,063,173
Total domestic copper	344,998,679	329,354,398	354,188,374	380,613,404	460,061,430
From imported pyrites and ores and matte	7,973,065	10,431,574	10,678,434	[c] 5,300,000	[c] 5,900,000
Total (including copper from imported pyrites)	352,971,744	339,785,972	364,866,808	385,913,404	465,961,430

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[a] Copper smelters in Colorado, purchasing argentiferous copper ores and mattes in the open market, sources not known. The quantity of Montana matte which goes to one of these works has been deducted.

[b] For 1896 the quantity stated covers only that part of the incidental copper product the source of which could not be ascertained.

[c] Estimated.

Total copper production in the United States from 1892 to 1901, inclusive—Continued.

[Pounds.]

Source.	1897.	1898.	1899.	1900.	1901.
Lake Superior	145, 282, 059	158, 491, 703	147, 400, 338	145, 461, 498	156, 289, 481
Arizona	81, 530, 735	111, 158, 246	133, 054, 860	118, 317, 764	130, 778, 611
Montana	230, 288, 141	206, 173, 157	225, 126, 855	270, 738, 489	229, 870, 415
New Mexico	701, 892	1, 592, 371	3, 935, 441	4, 169, 400	9, 629, 884
California	11, 987, 772	16, 925, 634	26, 221, 897	28, 511, 225	33, 667, 456
Utah	3, 919, 010	3, 750, 000	9, 584, 746	18, 354, 726	20, 116, 979
Colorado, including copper smelters [a]	11, 873, 033	16, 274, 561	11, 643, 608	7, 826, 949	9, 801, 783
Wyoming		233, 044	3, 104, 827	4, 203, 776	2, 698, 712
Nevada		437, 396	556, 775	407, 535	593, 608
Idaho	183, 277	1, 266, 920	110, 000	290, 162	480, 511
South Dakota	2, 440, 338	1, 261, 393	17, 020	15, 147	753, 510
Maine and New Hampshire Vermont Tennessee and Southern States Middle States	4, 472, 017	5, 395, 226	4, 410, 554	4, 820, 495	6, 860, 039
Lead desilverizers, etc. [b]	1, 400, 000	3, 553, 336	3, 500, 000	3, 000, 000	531, 530
Total domestic copper	494, 078, 274	526, 512, 987	568, 666, 921	606, 117, 166	602, 072, 519
From imported pyrites and ores and matte	[c] 12, 000, 000	[c] 19. 750, 000	[c] 23, 800, 000	[c] 36, 380, 000	64, 000, 000
Total (including copper from imported pyrites)	506, 078, 274	546, 262, 987	592, 466, 921	642, 497, 166	666, 072, 519

[a] Copper smelters in Colorado, purchasing argentiferous copper ores and mattes in the open market, sources not known. The quantity of Montana matte which goes to one of these works has been deducted.

[b] For 1896 the quantity stated covers only that part of the incidental copper product the source of which could not be ascertained.

[c] Estimated.

Since July, 1892, Mr. John Stanton, of New York, has collected monthly, from sworn returns, the following figures showing the production of the leading mines of Lake Superior, Montana, and Arizona. The estimate of outside sources is drawn, particularly recently, from official returns of many of the principal outside mines, large and small.

American production of copper.

[Long tons.]

Year.	Reporting mines.	Outside sources.	Total.
Second six months of 1892	59, 239	6, 287	65, 526
1893	129, 760	12, 730	142, 490
1894	142, 543	17, 080	159, 623
1895	155, 497	15, 700	171, 197
1896	189, 494	14, 400	203, 894
1897	204, 206	11, 900	216, 106
1898	216, 222	18, 050	234, 272
1899	230, 806	31, 400	262, 206
1900	227, 987	40, 800	268, 787
1901	223, 355	41, 900	265, 255

The monthly reports, in detail, for the years 1892, 1893, and 1894 are published in Mineral Resources for 1895; for the years 1895 and 1896 in Mineral Resources for 1896, and for 1897 and 1898 in Mineral Resources for 1898. For 1899, 1900, and 1901 the monthly production was as follows:

American production of copper, monthly, 1899, 1900, and 1901.

[Long tons.]

Month.	1899.			1900.			1901.		
	Reporting mines.	Outside sources.	Total.	Reporting mines.	Outside sources.	Total.	Reporting mines.	Outside sources.	Total.
January	16,774	1,850	18,624	17,613	3,400	21,013	19,279	3,400	22,679
February ...	17,899	2,000	19,899	17,497	3,400	20,897	17,700	3,400	21,100
March	19,918	2,000	21,918	19,883	3,400	23,283	19,984	3,400	23,384
April	17,854	2,100	19,954	20,667	3,400	24,067	18,038	3,400	21,438
May	19,832	2,250	22,082	19,282	3,400	22,682	18,892	3,500	22,392
June........	19,710	2,300	22,010	19,235	3,400	22,635	18,901	3,500	22,401
July	18,533	2,800	21,333	19,612	3,400	23,012	18,585	3,400	21,985
August	19,886	2,800	22,686	17,667	3,400	21,067	19,267	3,400	22,667
September..	19,515	3,200	22,715	17,986	3,400	21,386	18,080	3,500	21,580
October	20,680	3,300	23,980	19,945	3,400	23,345	20,498	3,600	24,098
November..	19,817	3,400	23,217	19,876	3,400	23,276	18,128	3,600	21,728
December ..	20,388	3,400	23,788	18,724	3,400	22,124	16,003	3,800	19,803
Total .	230,806	31,400	262,206	227,987	40,800	268,787	223,355	41,900	265,255

A considerable number of foreign mines, including those of the Peninsula, the Cape, Australasia, Germany, and Mexico, report monthly to a secretary in London since July, 1892. Since then the product of this group, which maintains friendly relations with the American Producers' Association, has been as follows:

Foreign reporting mines.

[Long tons.]

Year.	Quantity.	Year.	Quantity.
Second half of 1892....................	39,655	1897....................................	88,270
1893	81,785	1898....................................	84,554
1894	88,531	1899....................................	89,240
1895	86,178	1900....................................	89,431
1896	86,196	1901....................................	100,241

The increase in 1901 is probably due chiefly to the Australian mines.

According to the careful compilations of Mr. John Stanton, the exports of fine copper during recent years have been as follows:

Exports of fine copper from the United States.

[Long tons.]

Year.	Quantity.	Year.	Quantity.
1893	80,392	1898	145,115
1894	77,527	1899	119,811
1895	64,722	1900	160,082
1896	125,605	1901	94,366
1897	129,210		

The details of this heavy falling off in the exports are dealt with elsewhere in this report.

LAKE SUPERIOR DISTRICT.

In previous volumes of the Mineral Resources the production of the individual mines has been tabulated from 1884 to 1891, both inclusive. Since that some of the producers have reported to this office only with the understanding that the returns be regarded as confidential. The production of the majority of the mines is, however, given accurately in the published annual reports to stockholders. From these the following table has been compiled:

Production of some of the leading Lake Superior copper mines, from 1896 to 1901, inclusive.

[Pounds.]

Mine.	1896.	1897.	1898.	1899.	1900.	1901.
Tamarack	16,044,860	20,222,529	23,000,000	18,565,602	19,181,605	18,000,852
Quincy	16,863,477	16,924,618	16,354,061	14,301,182	14,116,551	20,540,720
Osceola	6,251,304	11,201,103	11,900,000	11,358,049	12,567,131	13,723,487
Kearsarge	1,377,226					
Tamarack, jr	2,135,000					
Franklin	2,746,076	2,908,284	2,623,702	1,230,000	3,663,710	3,757,419
Atlantic	4,895,985	5,109,663	4,377,399	4,675,882	4,930,149	4,666,889
Central	469,243	611,172	291,339	....	....	....
Wolverine	2,220,933	2,316,296	4,588,114	4,756,646	4,778,829	4,946,126
Baltic	....	....	42,766	621,336	1,735,060	2,641,432

During the fiscal year ending April 30, 1902, the Calumet and Hecla Mining Company produced 39,982 long tons of refined copper, compared with 36,326 long tons during the previous fiscal year, when the output was hampered by a fire. The company has completed the addition to the Hecla stamp mill, which is to be used in stamping rock from the Osceola amygdaloid lode. The company made very large additions during the fiscal year to the equipment at the mines, the mills, and the smelters.

During the year 1900 the Tamarack Mining Company produced 18,000,852 pounds of ingot from 29,998,094 pounds of mineral. The quantity of rock mined was 773,783 tons, and the amount of rock stamped was 626,905 tons. The average yield of the rock stamped was therefore 27.12 pounds of ingot copper, as compared with 30.67 pounds in 1900. During the year No. 5 shaft reached a depth of 4,938 feet, and the work of equipping it with machinery has been progressing, involving an outlay of $251,089.87 for extraordinary construction expenses. The total receipts for the year were $2,627,954.35, and the cost of production, not including extraordinary construction expenses, was $1,820,547.90, leaving a profit of $807,406.45. Dividends to the amount of $1,200,000 were paid, and extraordinary construction expenses of $281,240.51 were incurred, thereby reducing the balance of assets on December 31, 1900, of $1,213,369.39 to $539,535.33 on December 31, 1901. The average price realized for copper during the year was 14.22 cents.

The expected increase in the production of the Quincy mine, as the result of the improvements completed in 1900, has been realized. During 1901 there were crushed 886,266 tons of rock in the stamp mill, yielding 21,457,285 pounds of mineral, and there were obtained from the rock houses 6,320,983 pounds of mineral. The product was 20,540,720 pounds of refined copper, as compared with 14,116,551 pounds in 1900, and with a former maximum of 16,924,618 pounds in 1897. There has been realized from the sale of copper $3,327,071.92. The running expenses at the mine footed up $1,539,313.20; the taxes in Michigan were $62,222.39, and the smelting, transportation, and other expenses were $206,303.65. This left, as mining profit, $1,519,232.68, to which must be added sums realized from interest, $9,176.38, and from the sale of real estate, $63,326.50. The construction cost was $167,192.77, leaving a net income of $1,424,542.79. Dividends aggregating $1,000,000 were paid out of the 1901 earnings, and $200,000 was set aside for machinery contracts. The company is building an extensive coal unloading and storage plant. The average number of miners employed was 533, and the wages on contract, per month, were $62. The yield of refined copper per fathom of ground broken was 409 pounds, as compared with 391 pounds in 1900 and with 427 pounds in 1899.

The annual report of the Osceola Consolidated Mining Company attracted widespread interest in the metal trade because it revealed clearly the effects of the policy of withholding a considerable part of the product from the market in order to maintain prices. It was shown in the report of an investigating committee of the stockholders that the company on January 1 had a stock of 3,343,615 pounds of copper. The production of 1901 was 13,723,487 pounds. There were on hand at the close of the year 8,172,797 pounds. The result was that the company received for its copper, during the year 1901, 13.90 cents per pound. The company reports gross receipts of $1,934,437, while the total expenses were $1,699,536, leaving a net income of $234,901. The dividends paid were $576,900. Included in the outlays were $236,415 for the new stamp mill of 7 heads, $72,632 for sinking fund and construction of two shafts at the South Kearsarge, and $174,433 for extraordinary construction.

During the year there were mined 958,272 tons of rock, as compared with 836,372 tons in 1900 and with 674,691 tons in 1899. The quantity of rock stamped was 793,207 tons in 1901, 683,066 tons in 1900, and 546,326 tons in 1899, the production of ingot copper being, respectively, 13,723,487 pounds, 12,850,036 pounds, and 11,075,572 pounds. This shows that the yield declined from 20.2 pounds per ton of rock stamped in 1899 to 18.8 pounds in 1900 and to 17.3 pounds in 1901. An interesting fact is pointed out by Captain Parnell, the superintendent. In the old Osceola mill, which will soon go out of commission, the losses in the tailings could not be reduced below an average of about 0.26 per cent. In the new Osceola mill the average for the year 1901 was 0.094 per cent. This represents a difference of 2.39 pounds of ingot per ton of rock, which on 687,094 tons stamped represents 1,642,154 pounds of ingot copper.

The annual report of the Franklin Mining Company shows that there were produced 3,757,419 pounds of fine copper, of which 2,961,169 pounds were sold at 16.69 cents, thus realizing $494,436. During the year 20,000 shares of treasury stock were sold for $300,000. The mine agent's drafts amounted to $546,788, and other expenses, including smelting, freight, etc., were $51,510. The new mill of 3 heads stamped 313,552 tons of rock at an average cost of 25.75 cents per ton. It yielded 4,927,061 pounds of mineral, and the mass and barrel work was 544,211 pounds.

The work on the Pewabic amygdaloid lode of the Franklin, jr., has been suspended and operations are confined to the Peninsula conglomerate. The old Franklin mine is still yielding from 9,000 to 10,000 tons of rock per month, and promises to do so for several years to come. The cost in January, 1902, was 12 cents per pound, and in February it had been reduced to 11.37 cents per pound.

The Atlantic Mining Company produced from 409,124 tons of rock stamped in 1901 6,317,645 pounds of mineral, which yielded 4,666,889 pounds of refined copper, or only 0.57 per cent in the rock treated. The copper was sold at an average of 15.76 cents per pound, yielding $735,577.32. The working expenses at the mine were $573,341.59, the freight, smelting, and interest, $62,954.49, which left a surplus over running expenses of $99,281.24. There was received for the sale of surface rights $11,600. On the other hand, there was expended for improvements and construction $184,537.65 and for exploration

$6,606.21, so that there was an excess of expenditure of $80,262.62. The surplus from 1900, after payment of dividend, was $175,962.27, which made the net surplus $95,699.65. The company has completed the hoisting plant at one of its shafts and is installing a high-duty compressor plant. The exploration in search of the Baltic lode has been continued.

The record of costs of the Atlantic mine for a long series of years is shown in previous volumes of the Mineral Resources. From 1896 to 1901, inclusive, it has been as follows:

Cost of copper at the Atlantic mine per ton of rock treated from 1896 to 1901, inclusive.

[Cents.]

Items of cost.	1896.	1897.	1898.	1899.	1900.	1901.
Mining, selecting, breaking, and all surface expenses, including taxes	76.43	73.43	89.11	103.60	103.58	110.48
Transportation to mill	4.96	4.54	5.55	6.50	6.92	7.67
Stamping and separating	24.87	23.94	24.11	23.35	24.70	21.98
Freight, smelting, marketing, and New York expenses	17.47	17.03	16.04	17.04	14.70	15.39
Total working expenses	123.73	118.94	134.81	150.49	149.90	155.52
Total expenditures, including construction	135.99	129.69	153.59	171.11	177.65	202.24
Yield of copper, per cent	0.660	0.648	0.590	0.614	0.602	0.57

The Centennial Mining Company is engaged chiefly in developing work on the Kearsarge lode, adjoining the Wolverine. A moderate amount of copper was produced during 1901 with an inefficient old mill. The receipts during the year aggregated $524,139, including $118,959 from sales of copper and $212,415 from assessments. The Centennial is to use two heads of the Arcadian mill after July 1.

For the fiscal year ending June 30, 1902, the Wolverine Copper Mining Company reports a product of 6,232,800 pounds of mineral, which yielded 4,984,367 pounds of refined copper. This was sold at an average of 13.21 cents per pound, making the receipts, including interest, $665,333.28. The working expenses at the mine were $364,093.29, and the cost of smelting and marketing, $60,236.47, thus leaving a mining profit of $241,003.52. The outlays for construction were $264,677.90, and the dividends $240,000, which reduced a surplus at the end of the previous year of $540,141.88 to $276,467.50. There were hoisted 213,650 tons of rock, of which 26,168 tons were discarded. The stamp mill handled 187,482 tons of rock, which yielded 26.59 pounds of fine copper. The cost of production of copper per pound, exclusive of construction account, was 8.512 cents. The stamp mill which is in course of completion is expected to increase the capacity from an average of a little more than 600 tons per day to 900 to 1,000 tons per day. It is believed that the cost of production will then be in the neighborhood of 8 cents per pound.

The Mass Consolidated Mining Company is another of the old Lake Superior copper properties which are being developed on modern lines. The bulk of the work has been done on the Evergreen lode. In August, 1901, the first head of the new stamp mill was put in commission, and the second head followed early in 1902. The mine produced nearly 900,000 pounds fine copper, and the gross receipts from sales and from assessments were $576,500. The expenditures were $577,603, including $211,277 underground expenses, $24,302 stamping expenses, $26,012 for smelting and marketing copper, $128,358 for buildings and machinery at the mine, and $180,075 for buildings and machinery at the mill.

The Isle Royale Copper Company began stamping rock in its new mill of three stamps in May, 1901, but was not able to furnish a full supply of rock because a considerable part of the quantity mined had to be left in the stopes as support for the miners. Full work was attained in the spring of the current year, which is expected to bring up the annual product of copper to about 6,000,000 pounds ingot. During 1901 the quantity of rock hoisted was 201,951 tons, of which 185,175 tons were stamped, yielding 3,172,509 pounds of mineral, equivalent to 2,171,955 pounds of ingot. The cost per ton of rock stamped was $1.863, which was distributed as follows: Mining $1.200, rockhouse $0.109, transportation $0.055, stamping $0.249, surface expense $0.039, office expenses $0.030, and incidental expenses $0.181. Explorations were begun on the Portage lode, which runs parallel with and from 150 to 220 feet west of the Isle Royale lode. This lode has shown a better average than the Isle Royale lode proper, which has yielded in 1901 about 11.75 pounds of ingot per ton of rock stamped. The receipts for 1901 were $281,269.22 from copper produced, interest receipts, and other income, and $832,742.21 balance of assets on December 30, 1900. The running expenses at the mine were $344,966.28, the smelting and other expenses were $57,590.26, and the construction account was $305,039.69, leaving a balance of assets of $406,415.20.

The most active development in the immediate past and the greatest prospective increase in output in the near future are to be credited to the South Range group of mines, which includes the Trimountain, the Baltic, and the Champion properties. Before the close of the current year there will be in operation for these three mines three modern mills with four stamps each, which together should crush about 5,000 tons of rock per day, which would represent an annual product of at least 50,000,000 pounds of ingots.

The Baltic mine is furthest advanced in development, having been a regular producer since 1899. In 1901, according to the annual report, there were obtained 2,641,432 pounds of copper, which, selling at the high average of 16.43 cents per pound, yielded $433,987. Assessment

No. 4 produced $300,000, the previous assessments having aggregated $500,000. The total receipts were $742,550, and the expenditures, including $534,990 for construction and $10,000 for a stamp-mill site, aggregated $827,949. The company has during the year become a part of the Copper Range Consolidated Company. There were crushed during the year, at the Atlantic mill, 114,703 tons of rock, which produced 3,564,670 pounds of mineral, from which there were obtained by smelting 2,641,432 pounds of refined copper. The yield per ton of rock stamped was 23 pounds of fine copper, as compared with 19.58 pounds in 1900, and with 17 pounds in the six months' stamping in 1899, thus showing a steady increase. The development of the mine and the construction of the stamp mill were hampered by delays in delivery of machinery. The first head of the new stamp mill went into commission in the latter part of December. The others will begin to drop during the current year.

The Trimountain has been actively developed during 1901, and will become an important contributor to the product of the Lake district. The receipts during the year were $570,070, including cash on hand January 1, 1901, $262,376, and $241,676 balance of assessment No. 1. The expenditures were $568,760, including $234,984 for mining expenses, $45,734 for construction at the mine, $23,973 for machinery and equipment at the mine, $158,712 for construction at the mill, and $22,517 for machinery and equipment at the mill. In the mine at the end of the year 1901 there were openings to the aggregate of 13,000 feet. In January, 1902, crushing of rock at one head of the Arcadian mill was commenced, the returns showing that the Trimountain amygdaloid is exceptionally rich. The company is building a mill with four stamps, which it is expected will be in commission before the winter.

The Champion, the third mine of the group, is being developed rapidly and is believed to be of promise.

Steady progress has been made during 1901 in the work of opening the Mohawk mine and equipping it for production. The mine has been opened on the Wolverine lode, and it is expected that the new mill will begin stamping in July. There were expended at the mine during 1901 $413,311.60, including $128,533.99 for underground work, $28,527.99 for surface expense, and $256,249.62 for railroad, mine, and mill construction. Since its organization the net expenditures for mining operations and equipment have footed up to $824,736, there having been collected on account of two assessments $538,407, and $300,000 for capital stock issued for cash. Some copper has been produced in the form of "mohawkite," which is found in little cross fissures and which is entirely incidental; the value of the mine depends upon the yield of the Wolverine lode proper.

Explorations have continued on a moderate scale on the property of the Winona Copper Company, the principal expenditures having been made on the Winona amygdaloid. It is probable that a working test of the rock will be made by leasing a head of stamps in the Atlantic mill.

The Phœnix Consolidated Copper Company has continued development of the St. Clair and West veins, and the work has progressed far enough to justify the erection of a one-head stamp mill on the Eagle River.

MONTANA.

The decline in the production of copper in Montana in 1901 is due chiefly to the restriction of operations of the Anaconda mine. The Boston and Montana and the Butte and Boston together made more copper in 1901 than they did in 1900, and the same is true of the Montana Ore Purchasing Company, now controlled by the United Copper Company. The Boston and Montana Company has considerably improved the Great Falls plant, and some heavy new machinery has been put into the principal mines.

The copper production of the State continues to suffer from the endless litigation among some of the leading properties.

The Anaconda Copper Mining Company was engaged during 1900 and in 1901 in building enormous new concentrating mills and smelting works at Anaconda, Mont. The concentrator consists of 8 sections, which have a capacity each of 600 tons of ore per twenty-four hours. The roasting plant is equipped with 48 McDougal furnaces with a roasting capacity of 40 tons per twenty-four hours. The calcined concentrates are smelted in 14 reverberatory furnaces, whose capacity is rated at 120 tons each in twenty-four hours, and the blast furnace department has 5 furnaces, with a smelting capacity of 400 tons each. The converting works have 2 reverberatory storage furnaces, 8 converter stands, and 3 casting furnaces. The whole plant is on a magnificent scale, and went into operation in the spring of 1902, adding greatly to the producing capacity of the district.

The United Copper Company of Montana was formed in April, 1902, to take over the properties developed by Mr. F. A. Heinze and his associates. The new company has an authorized capital stock of $75,000,000 of common stock, of which $45,000,000 has been issued, and $5,000,000 of 6 per cent preferred stock. The company has in its treasury 95 per cent of the capital stock of the following companies, whose capitalization is appended: Montana Ore Purchasing Company, $2,500,000; Nipper Consolidated Copper Company, $3,750,000; Minnie Healy Copper Mining Company, $2,000,000; Cora and Rock Island Copper Mining Company, $2,000,000; and Belmont Copper Mining Company, $1,000,000. There are also in the treasury $1,000,000 in 6 per cent bonds of the Montana Ore Purchasing Company, and $2,500,000 in 6 per cent bonds of the Nipper Consolidated Copper Company. It is understood that $2,500,000 in cash went into the treasury. The Montana Ore Purchasing Company has for a number of years operated a smelting plant, whose capacity has been gradually increased until it has reached 3,500,000 pounds per month.

For some time past Mr. Franklin Farrall, conspicuously identified with the development of the Butte district, has been opening new ground. It is reported that this has progressed so far that the erection of a smelting plant will be begun at an early date.

ARIZONA.

The increase in the production of copper in Arizona has almost entirely come from old-established mines, notably, the Copper Queen, the Detroit, and the Old Dominion. On the other hand, the United Verde Company showed a considerable falling off, owing to special causes.

In the Clifton district the Shannon Copper Company was actively engaged in developing its property in 1901, and became a producer in May, 1902, the plant of two furnaces of 44 by 170 inch section having started with one stack in blast. It is expected that the concentrating mill and the converting works will follow later on. The capacity of the company is estimated at about 750,000 to 900,000 pounds of fine copper per month. The company has a capital stock of $3,000,000, listed on the Boston Stock Exchange, and has a bonded indebtedness of $600,000 of 7 per cent bonds, the mortgage providing for a sinking fund of 20 per cent of the net earnings. On March 31, 1902, the company had $335,490 cash in the treasury, of which $300,000 is to be applied to the building of the concentrator and converter plant.

The Arizona Copper Company has expanded its operations and may reach a production of close to 30,000,000 pounds. During the second half of the fiscal year ending September 30, 1901, the production of copper was interfered with by the rebuilding of the smelting works. Yet during that period there were smelted 29,285 tons of first-class ores and concentrates, and 1,181,612 pounds of copper were derived from the leaching plant, which yielded 8,422,690 pounds of copper. In the concentrating mill 102,961 tons of ore were handled, producing 17,049 tons of concentrates. The financial results for the fiscal year showed receipts of £622,937 from copper produced, £134,127 from the Arizona and New Mexico Railroad, and £243 transfer fees. The outlays were £360,629 for mining and smelting, £11,146 for general charges, and £41,323 for railroad expenses, leaving a profit of £344,209. Interest on debentures and preferred stock, etc., amounted to £78,569, leaving a balance of £265,640. The dividends for the year absorbed £298,543.

In the Bisbee district the Copper Queen Mining Company is to transfer its smelting plant to the new town of Douglas. The works will not be completed until 1903, and it is not the intention of the company to increase the copper production. The plant, however, will have reserve capacity to handle custom ores. The Calumet and Arizona, which has been developing mines in the same district, is also erecting a smelting plant at Douglas, which it is expected will begin operations during the fall of the current year, with one blast furnace and one stand of converters having a rated capacity of about 750,000 pounds of fine copper per month.

In the Verde district the United Verde has been remodeling its smelting plant and may be expected somewhat to exceed its record of 1900. The mine suffered from a cave in which affected the smelting works, and it was idle for some time owing to a strike.

In the Globe district Boston interests have organized the Arizona Commercial Company, the property being developed by a shaft. There has been a proposal to erect a smelting plant.

The control of the Old Dominion Copper Company has passed into other hands, and it is likely to become a heavier producer of copper.

The Val Verde Copper Company, Limited, at Val Verde has a matting custom plant which was not in operation in 1901, but which commenced work in 1902. It has a capacity of about 60 tons of ore per twenty-four hours.

Wheeling capital is largely interested in the Black Diamond Copper Mining Company, which has mines in the Dragoon Mountains, 18 miles from Cochise, on the main line of the Southern Pacific Railroad. In 1901 the company was building a smelting plant furnished by the Allis-Chalmers Company, of Chicago.

The Troy Copper Company, at Troy, Pinal County, which has been shipping ores to smelters for some time, proposes to build a water-jacket furnace for smelting the ores at the mine.

Reports have been in circulation that the Westinghouse mines at Duquesne, which have been under development for some years, are to be provided with a smelting plant, to be erected at Nogales.

CALIFORNIA.

The Mountain Copper Company is by far the largest copper producer in the State, having produced in 1901 26,174,019 pounds fine. Considerable improvements have been made in the plant and equipment which will reduce costs. Although the reserves continue satisfactory, exploration for new ore bodies has developed only large quantities of low-grade material. It is not probable, therefore, that in the near future any notable addition will be made to the rate of output of recent years.

A new producer in California is the Bully Hill Copper Mining and Smelting Company, at Bully Hill, Shasta County, whose works were started on May 14, 1901, and have a capacity of about 750,000 pounds per month. Mr. J. R. De Lamar, who is interested in this enterprise, is building a refining plant at Carteret, N. J.

The Trinity Copper Company, which was organized in Boston, has been opening up mines near Kennett, Shasta County, and is building a smelting plant, which, however will probably not be finished until the fall of 1902.

In Calaveras County Lewis Williams and Ben Williams, long identified with the copper industry, have been steadily developing the Napoleon mine.

The Ivanpah and California Copper Company's plants were idle during 1901.

UTAH.

Formerly the greater part of the copper produced in Utah was derived from the ores treated by the local lead smelters and those of Colorado, and was therefore incidental, but now considerable and increasing quantities are obtained from low-grade copper ores, which, however, carry also the precious metals. The current year will witness a further increase in the yield.

The report of the Utah Consolidated Gold Mines, Limited, of London, which own practically all of the stock of the Highland Boy Gold Mining Company of Utah, shows dividends on the stock of that company of £163,195. The Highland Boy produced 166,343 tons of ore, and the accounts show $1,598,362 from the sales of metal, $344,852 increase of stocks on hand, and $1,380 rents, etc., a total of $1,944,594. The sales were 14,782 ounces of gold for $295,645; 240,880 ounces of silver for $137,157; and 7,123,197 pounds of copper for $1,596,703. The expenses aggregated $1,312,110, including $314,236 for mining, $29,075 for development and maintenance, $501,135 for smelting, $242,868 for matte and ore purchases, $180,960 for freight, refining, and storage, and $43,836 for general expenses. This left a balance of profit of $632,484. It appears that when the price of copper declined in December, 1901, the company had approximately 1,500,000 pounds of refined copper on hand and 2,500,000 pounds in transit and in process of refining. The smelting plant, which went into full operation on February 1, 1901, handled 167,823 tons of Highland Boy ore, which yielded 13,983 ounces of gold, 176,331 ounces of silver, and 9,043,967 pounds of copper, or 0.08 ounce of gold, 1.05 ounces of silver, and 2.7 per cent of copper per ton. The company also treated 1,651 tons of matte of the Bingham Copper and Gold Mining Company, which yielded 2,931 ounces of gold, 100,068 ounces of silver, and 1,041,801 pounds of copper. During the year the company acquired the Yampa Extension, the Keepapitchinin, and the Rattlesnake claims, into which the principal ore body worked extends. At least one important new ore body was discovered during the year, the reserves at its close being estimated at 950,000 tons.

The Bingham Copper and Gold Mining Company has been active in developing its mines and completing its smelting plant at Jordan. The Dalton and Lark Railroad, connecting the mines with the Rio Grande and Western Railroad, on which the smelter is located, was completed in the spring of 1902. Two of the blast furnaces were in operation in 1901, a large part of the matte produced going to the Highland Boy converting plant. In May, 1902, the Bingham Company completed its own converter installation, and a third blast furnace was started. This is to be followed by a fourth, which will bring the capacity up to 800 to 1,000 tons per day. The smelter will do custom work also. The plans include the erection, also, of lead furnaces, some of the mines yielding lead and silver ores.

The United States Mining Company, which controls the Centennial, Eureka, and other mining properties, is building at Murray, Utah, a smelting plant of six furnaces, with an estimated capacity of 850 tons of ore per day. It is also being equipped with converters. It is not likely that these works will be in operation until well into the fall of 1902.

NEW MEXICO.

During the year the new smelting works of the Santa Fe Gold and Copper Company were started on ores reported to average 4.75 per cent of copper, and some silver and gold. The production, however, is small, and the operations are hampered by the distance of the plant from the railroad. The matte is shipped to the Nacosari works in Mexico to be bessemerized.

The greater part of the copper credited to the Territory comes from scattered mines whose ore is treated at the works at Silver City.

COLORADO.

Colorado has few copper mines proper, but the ores mined in the State contain metal which is incidentally obtained by lead smelters in works like that at Argo, which employ copper as the carrier in extracting the precious metals, and more recently by an increasing number of pyritic smelters.

IDAHO.

The mines of the Seven Devils district of Idaho have shipped some high-grade ores to distant smelters. The development of the district has progressed, but production on a large scale can not be expected until the Boston and Seven Devils Copper Company has completed the smelting plant now under construction near Weiser, on the Oregon Railroad and Navigation line, and until the Pacific, Idaho and Northern Railroad, completed to Council, is carried 45 miles farther to Landore, its terminus for the mines.

The White Knob Copper Company, at Mackey, Custer County, Idaho, has been developing copper mines and is building two 300-ton furnaces, which are expected to produce during the second half of 1902 at the rate of about 1,000,000 pounds per month.

NEVADA.

In Nevada there has been some activity in developing copper mines. In the Bristol district a number of old mines are being opened, and the parties in interest have leased the smelting works at Pioche, which are being remodeled.

WYOMING.

The Grand Encampment district of Wyoming has continued to depend during 1901 upon the shipment of rich ores to distant works, the Chicago Copper Refining Company at Blue Island, Ill., treating the greater part of them. In January, 1902, however, the smelting works of the Boston and Wyoming Smelting, Power, and Light Company was started. Since then it has been consolidated with the Ferris-Haggerty mining property under the title of the Northern Consolidated Copper Company.

SOUTH DAKOTA.

At Rapid City, S. Dak., a large smelting plant is under construction, chiefly for the treatment of auriferous ores, which however, will also produce some copper.

TENNESSEE.

The extensive improvements in mining equipment and smelting plants begun in 1899 by the Tennessee Copper Company were practically completed in 1901. Smelting was begun in August, 1901, but it was really not until May, 1902, that the plant attained its full capacity. This is measured by the smelting of about 5,000 tons of roasted ore weekly, equal to about 200,000 pounds of pig copper. With its present equipment the Tennessee Copper Company will make about 10,000,000 pounds of copper per annum.

The statement of the treasurer for the period June 15, 1899, to January 1, 1902, shows receipts of $1,432,353.05, which include $12,136.65 on store profits and $9,203.29 for rents and royalties. The expenditures, which are interesting as showing the cost of equipment, include $202,997.20 for mine development, $138,761.38 for mine equipment, $81,259.83 for roast-yard construction, $190,330.84 for railroad construction, $42,774.15 for railroad equipment, $301,897.49 for smelter construction, and $34,922.08 for stores and dwellings.

The report of Mr. J. Parke Channing, consulting engineer of the Tennessee Copper Company, states that there are easily available above the bottom levels of the mines 1,500,000 tons of ore. During 1901 the equipment at the various mines—the Polk County, the London, and the Burra Burra mines—has been completed, that at the latter being especially fine. A 7.5-mile railroad has been built to connect the three mines with the three roast yards, the smelter, and with the Atlanta, Knoxville and Northern Railway at Isabella.

The three roast yards have a capacity of over 100,000 tons of ore, and since about May 1, 1901, when regular mining was begun, 145,826 tons of ore have been placed in them. The smelting plant, which was started early in August, 1901, has two blast furnaces 56 by 180 inches at the tuyeres and 18 feet high. The matte is bessemerized in two stands of converters, and a reverberatory refining furnace was built in 1902.

In 1901 one furnace was in operation, which smelted 312 tons of siliceous ore and the equivalent of 57,002 tons of sulphide ore. The furnace, however, so steadily exceeded its capacity that the blowing in of the second stack was held back until a sufficient supply of roasted ore could accumulate. Including flux, converter slag, and other by-products treated, the tonnage of charge put through the furnace increased from 357 tons in August to slightly above 550 tons in January. Mr. Channing expresses the belief that before the close of the year 1902 the cost of producing fine copper laid down in New York will not exceed 8.50 cents per pound.

The Tennessee Company draws some revenue from the iron-ore deposits, which are operated under lease by the Virginia Iron, Coal, and Coke Company. The shipments in 1901 were 79,267 long tons.

The second producer in Tennessee, the Ducktown Sulphur and Copper Company, has run at the rate of former years.

VIRGINIA.

A good deal of activity has been displayed in recent years in the Virginia district of Person County, N. C., and Halifax County, Va. The Eustis mines have been shipping steadily to a smelting works at Norfolk, Va. The Virginia Copper Company, Limited, has been putting up a concentrating plant, and other properties are being opened. The ore is described as pockety, but high and pure in grade.

VERMONT.

In Vermont the Copperfield mines, which belong to Mr. George Westinghouse, of Pittsburg, did not complete their plant until January, 1902, so that there was no production in 1901.

IMPORTS.

In former volumes of Mineral Resources tables have been published showing the imports from 1867 of fine copper contained in ores, and of regulus or matte and black copper, and of ingot copper, old copper, plates not rolled, rolled plates, sheathing metal, and manufactures not otherwise specified, and of brass. The following table furnishes the figures from 1890 to 1901, inclusive:

Fine copper contained in ores, and regulus and black copper imported and entered for consumption in the United States from 1890 to 1901, inclusive.

Year ending—	Fine copper contained in ores.		Regulus and black copper.		Total value.
	Quantity.	Value.	Quantity.	Value.	
December 31—	*Pounds.*		*Pounds.*		
1890	3,448,237	$241,732	221,838	$15,688	$257,420
1891	8,931,554	774,057	2,403,919	214,877	988,934
1892	7,669,978	453,474	303,087	17,390	470,864
1893	7,256,015	435,448	3,175,559	202,197	637,645
1894	4,804,614	260,402	5,873,820	144,832	405,234
1895	[a]8,921,920	213,689	[a]3,104,640	125,853	339,542
1896	[a]2,620,800	126,580	[a]3,427,200	210,725	337,305
1897	[a]43,919,680	683,497	2,974,720	226,704	910,201
1898	[a]107,253,440	565,245	1,583,680	92,135	657,380
1899	[a]120,934,616	1,141,180	7,763,885	784,232	1,925,412
1900	[a]109,123,840	2,164,386	27,534,080	2,966,449	5,130,835
1901	131,790,400	3,084,306	75,913,600	11,310,357	14,394,663

[a] Gross weight of ore.

Copper imported and entered for consumption in the United States, 1890 to 1901, inclusive.

Year ending—	Bars, ingots, and pigs.		Old, fit only for remanufacture.		Old, taken from bottoms of American ships abroad.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
December 31—	*Pounds.*		*Pounds.*		*Pounds.*	
1890	5,189	$859	284,789	$26,473	....	....
1891	2,556	389	134,407	9,685	....	....
1892	22,097	2,588	71,485	6,114	....	....
1893	554,348	58,480	59,375	6,945	....	$6,326
1894	606,415	42,688	160,592	15,726	....	1,143
1895	7,979,322	726,347	1,336,901	109,340	....	....
1896	9,074,379	750,976	2,422,554	196,419	....	....
1897	12,646,552	1,142,526	1,780,390	158,829	....	....
1898	35,892,944	3,094,541	1,986,133	168,405	....	....
1899	64,282,583	9,350,582	6,678,145	758,010	....	....
1900	62,404,489	9,931,059	3,354,756	373,957	....	....
1901	71,001,713	11,478,422	2,818,757	325,859	....	....

Copper imported and entered for consumption in the United States, 1890 to 1901—Cont'd.

Year ending—	Plates rolled, sheets, pipes, etc.		Sheathing metal, in part copper.		Manufactures not otherwise specified.	Total value.
	Quantity.	Value.	Quantity.	Value.	Value.	
December 31—	*Pounds.*		*Pounds.*			
1890	4,209	$917	37,458	$4,467	$24,752	$57,468
1891	122,219	23,291	228,486	29,112	12,926	75,403
1892	1,788	600	417,134	51,380	49,764	110,446
1893	7,056	1,065	1,670	167	16,166	89,149
1894	12,681	1,821	8,422	1,470	3,851	66,699
1895	27,156	2,586	5,698	389	13,166	851,828
1896	34,481	4,834	3,183	303	20,953	973,485
1897	3,116	430	15,282	1,929	30,729	1,334,443
1898	11,793	2,193	5,801	679	20,071	3,285,889
1899	827	331	13,763	6,310	13,629	10,128,862
1900	5,821	3,416	22,783	2,367	8,145	10,318,944
1901	19,248	6,761	5,237	807	8,610	11,820,459

The sources of the imports of copper in the form of pigs, bars, old material, etc., are shown in the following table for the calendar years 1899, 1900, and 1901:

Imports of copper pigs, bars, ingots, plates, old and other unmanufactured, in the calendar years 1899, 1900, and 1901.

Countries.	1899.		1900.		1901.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Pounds.		*Pounds.*		*Pounds.*	
France	7,121,944	$1,067,231	4,312,454	$658,180	1,022,178	$159,344
Germany	896,972	134,982	809,144	120,256	3,117,951	537,409
United Kingdom	34,188,172	5,200,036	36,809,986	6,341,696	43,838,699	7,539,801
Dominion of Canada:						
Quebec and Ontario	746,846	81,078	582,038	71,775	688,374	74,203
British Columbia	647,541	64,238	164,530	11,095	69,323	5,846
West Indies:						
British	507,006	52,675	466,064	42,458	328,206	37,252
Cuba	3,041,631	328,929	1,510,017	174,858	1,013,460	125,255
Santo Domingo	49,851	5,407	38,090	3,163	42,826	4,367
Mexico	19,703,367	2,511,760	20,168,888	2,664,249	23,024,376	3,245,564
Japan	112,020	15,187	2,478,967	305,933	224,850	33,185
British Australasia	4,029,645	584,698	....	....	....	....
All other countries	877,345	93,169	1,456,630	164,207	456,163	49,990
Total	71,922,340	10,139,390	68,796,808	10,557,870	73,826,406	11,812,216

Practically all of the copper from the West Indies and from "all other countries" is old copper, and nearly all of that credited to Mexico is in the form of converted product. Some of the copper which reached us from Great Britian is known to have been refined metal; a good deal of it, however, was so-called "standard copper," Chile bars, and converted product from Australia and elsewhere, brought to this country to be refined.

The following table, showing by customs districts the imports of bars, etc., during the calendar years 1899, 1900, and 1901, proves how largely the seaboard routes at New York and Baltimore handle the material:

Imports of copper pigs, bars, ingots, plates, old and other unmanufactured, by customs districts, calendar years 1899, 1900, and 1901.

Customs district.	1899.		1900.		1901.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Pounds.		*Pounds.*		*Pounds.*	
Baltimore, Md	12,645,594	$2,086,086	21,893,250	$4,175,209	27,866,379	$5,166,600
Newark, N. J	563,071	56,308	....	....	324	49
New York, N. Y	47,905,124	6,785,681	40,567,109	5,697,467	42,723,591	6,190,616
Passamaquoddy, Me	63,459	5,738	28,075	2,417	36,019	3,709
Perth Amboy, N. J	1,548,221	278,941	1,802,472	257,399	1,988,571	318,172
Corpus Christi, Tex	5,331,323	551,739	3,327,972	303,213	33,452	3,394
Arizona	2,656,631	247,445	193,000	17,250	....	....
San Francisco, Cal	61,441	5,021	57,437	5,484	18,407	1,686
Champlain, N. Y	368,028	49,717	199,746	24,324	440,493	45,242
Detroit, Mich	341,067	19,928	35,293	5,022	23,438	2,681
All other districts	438,381	52,786	692,454	70,085	695,732	80,067
Total	71,922,340	10,139,390	68,796,808	10,557,870	73,826,406	11,812,216

The imports of ore and of matte are shown in the following table for the calendar years 1899, 1900, and 1901:

Imports of copper ore and matte, by countries, in the calendar years 1899, 1900, and 1901.

Countries.	1899.		1900.		1901.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Tons.		*Tons.*		*Tons.*	
Germany	377	$103,618	138	$22,357	153	$45,219
Dominion of Canada:						
Quebec and Ontario	1,424	268,292	733	61,415	579	65,142
British Columbia	4,298	938,544	10,298	1,969,245	20,093	2,902,588
Newfoundland and Labrador	19,109	97,966	30,299	75,754	34,141	84,834
Mexico	3,681	606,859	8,176	1,900,662	30,469	9,378,197
Chile	2,748	228,304	4,372	1,036,293	8,337	2,109,049
All other countries			1,096	129,284	2,275	107,616
Total	31,637	2,243,583	55,112	5,195,010	96,047	14,692,645

All the figures of quantities in the above table deal with gross weights, and it is only through the values that a direct indication is furnished of the copper contents of the material. In a general way, however, much is known of the operations. Thus the exports from British Columbia consist largely of ore from the Rio mines, which are smelted at Northport, Wash. The ore exported from Newfoundland is from the Till Cove mines of the Cape Copper Company, and may be estimated to contain about 1,600 tons of copper. The Mexican and Chilean imports are copper matte, as is indicated by the valuations.

The following table shows the ports of entry, which throws some light on the movement of the material:

Imports of copper ore and regulus, by customs districts, during the calendar years 1899, 1900, and 1901.

Customs district.	1899.		1900.		1901.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Tons.		*Tons.*		*Tons.*	
New York, N. Y	24,054	$685,000	36,585	$1,302,524	45,138	$2,429,082
Corpus Christi, Tex	136	42,114	2,015	258,867	6,298	988,808
Paso del Norte, Tex	56	9,588	138	39,536	259	88,685
Arizona	1,585	317,926	5,260	1,556,451	23,143	8,187,714
Puget Sound, Wash	2,753	747,049	5,373	1,415,592	4,338	1,077,474
Memphremagog, Vt	361	29,540	322	28,985	305	19,141
Oswegatchie, N. Y	1,802	244,451	5,146	556,158	15,516	1,751,486
All other districts	890	167,915	273	36,897	1,050	150,255
Total	31,637	2,243,583	55,112	5,195,010	96,047	14,692,645

From the returns of refiners and a general study of the situation an estimate of 53,000,000 pounds seems justified as the copper contents of this material.

In addition thereto copper is recovered from imported pyrites which are not classed in the import returns as cupriferous material. Reports from those who handle this material justify an estimate of 5.000.000 pounds. Finally, we have the copper contents of the Sudbury nickel mattes, which we place at 6,000,000 pounds.

Thus the net supply for 1901 through imports of cupriferous furnace material may be estimated as follows, the figures for 1899 and 1900 having been arrived at in a similar manner:

Imports of copper in furnace material and ores in 1899, 1900, and 1901.

[Pounds.]

Source or condition.	1899.	1900.	1901.
In mattes and ores	13,750,000	25,000,000	53,000,000
In iron pyrites	4,500,000	5,000,000	5,000,000
In nickel mattes	5,550,000	6,380,000	6,000,000
Total	23,800,000	36,380,000	64,000,000

The total imports of copper from all sources and in all forms, therefore, have been the following:

Total imports of foreign copper, 1898 to 1901, inclusive.

[Pounds.]

Source or condition.	1898.	1899.	1900.	1901.
In bars, etc	54,166,467	71,922,340	68,796,808	73,826,406
In ores and mattes	19,750,000	23,800,000	36,380,000	64,000,000
Total imports	73,916,467	95,722,340	105,176,808	137,826,406
Less exports of foreign	23,647,968	2,550,149	1,281,782	12,888,083
Net imports	50,268,499	93,172,191	103,895,026	124,938,323

The apparently large quantity of foreign copper exported in 1898 is due to the fact that Boleo copper from Mexico in transit for Europe was not at that time counted as foreign copper, but was credited as American product. Since then it is not taken into account, being merely transit goods.

EXPORTS.

The exports of copper in different forms have been printed in former volumes of Mineral Resources for the period beginning June 30, 1863. Below the figures are submitted from 1890:

Copper and copper ore of domestic production exported from the United States, 1890 to 1901, inclusive.

[Cwts. are long hundredweights of 112 pounds.]

Year ending—	Ore and matte.		Pigs, bars, sheets, and old.		Value of manufactured product.	Total value.
	Quantity.	Value.	Quantity.	Value.		
December 31—	*Cwts.*		*Pounds.*			
1890	431,411	$4,413,067	10,971,899	$1,365,379	$139,949	$5,918,395
1891	672,120	6,565,620	69,279,024	8,844,304	293,619	15,703,543
1892	943,040	6,479,758	30,515,736	3,438,048	245,064	10,162,870
1893	835,040	4,257,128	138,984,128	14,213,378	464,991	18,935,497
1894	87,040	440,129	162,393,000	15,324,925	378,040	16,143,094
1895	276,480	1,631,251	121,328,390	12,222,769	1,084,289	14,938,309
1896	414,265	2,393,914	259,223,924	27,822,280	819,017	31,035,211
1897	181,280	1,199,029	277,255,742	30,597,645	958,379	32,755,053
1898	186,860	755,443	291,955,905	33,598,869	1,190,939	35,545,251
1899	74,540	442,868	246,826,331	41,190,287	1,852,499	43,485,654
1900	200,140	1,332,829	337,973,751	55,285,047	2,257,563	58,875,439
1901	292,260	2,536,549	194,249,828	31,692,563	1,842,336	36,071,448

The destination of our exports of copper bars, ingots, plates, and old copper during the years 1897, 1898, 1899, 1900, and 1901 is shown by the following table, the data having been furnished by the Bureau of Statistics:

Exports of copper bars and ingots for 1897, 1898, 1899, 1900, and 1901, and countries to which exported.

[Pounds.]

Country.	1897.	1898.	1899.	1900.	1901.
United Kingdom	63,774,004	88,443,870	50,675,849	63,522,445	36,819,100
Austria	5,918,993	7,478,730	6,354,287	11,258,115	8,616,964
Belgium	16,651,776	13,613,183	5,069,456	12,554,191	4,561,405
France	59,630,864	53,909,508	58,450,866	67,725,989	34,607,042
Germany	29,746,200	42,891,345	49,285,139	67,348,848	37,487,180
Netherlands	86,581,616	72,418,633	69,304,699	101,398,394	61,752,002
Italy	3,757,920	3,733,672	3,449,565	5,550,285	5,045,775
Russia	8,515,772	7,340,276	2,689,610	5,650,423	2,889,270
Mexico	2,678,597	253,975	285,222	296,684	217,437
British North America		1,523,505	985,525	1,616,778	1,232,577
West Indies		6,143	5,599	1,317	3,032
Other countries		343,065	270,514	1,050,282	1,018,044
Total	277,255,742	291,955,905	246,826,331	337,973,751	194,249,828

Of course a considerable, though unknown, part of the copper thus exported has been obtained from refining foreign bars and mattes. It is not by any means all of domestic production. Some of it is foreign material simply in transit, this being the case with considerable quantities of Mexican copper, particularly in the years 1897 and 1898.

Germany is by far our largest customer for copper, since the greater part of the metal shipped to the Netherlands is in transit for that country. On the other hand, some of the copper which goes to the United Kingdom is reshipped from there to other countries. The details of these movements can not well be followed.

Besides the copper classed as being of domestic origin—although, as stated, largely foreign material reworked here—moderate quantities of foreign copper are reexported direct. The Bureau of Statistics reports that in 1899 2,550,149 pounds, in 1900 1,281,782 pounds, and in 1901 12,888,083 pounds of foreign copper were exported.

The following table shows the export ports:

Domestic exports of ingots, bars, and old copper in 1897, 1898, 1899, 1900, and 1901, by ports.

[Pounds.]

District.	1897.	1898.	1899.	1900.	1901.
Baltimore, Md	88,389,939	87,027,133	90,786,853	86,264,231	54,377,355
Boston and Charlestown, Mass.	928,584	439,368	1,568,197	1,496,387	27,917
Newark, N. J		673,180			
Newport News, Va	5,899,609	2,638,868	4,085,580	2,016,000	1,568,567
Norfolk, Va		5,249,820	4,707,267		
New York, N. Y	167,344,812	178,400,314	134,412,540	230,178,643	133,540,150

Domestic exports of ingots, bars, and old copper in 1897, etc.—Continued.

[Pounds.]

District.	1897.	1898.	1899.	1900.	1901.
Philadelphia, Pa	227,023	68,624	2,733,692	12,468,680	3,526,130
New Orleans, La	13,882,408	15,508,831	7,459,623	3,937,350	1,806
Galveston, Tex	....	444,920	3,700	....	....
Detroit, Mich	164,317	728,689	320,121	469,819	387,923
Huron, Mich	229,226	118,827	107,562	149,525	92,062
Burlington, Vt	102,718	410,410	434,340	678,589	434,692
All others	87,106	246,921	206,856	314,527	293,226
Total	277,255,742	291,955,905	246,826,331	337,973,751	194,249,828

New York and Baltimore, the centers of the great refining industry of the country, are the principal export ports. The exports from New Orleans in 1897, 1898, and 1899 represented shipments of Mexican copper in transit.

An uncertain quantity in the exports is the copper ore and copper matte, concerning the copper contents of which only estimates can be made. It is known that some Arizona concentrates and mattes are shipped to Mexican smelters and Bessemer plants to be treated there, the metal reappearing in our imports as Mexican product. The copper content of the 14,613 long tons exported in 1901 may be estimated at 13,000,000 pounds, and that of the 10,004 long tons shipped in 1900 may be placed at 9,000,000 pounds.

The available supply for the domestic markets may be computed as follows:

Supply of copper for the United States from 1892 to 1901, inclusive.

[Pounds.]

Source.	1892.	1893.	1894.	1895.	1896.
Production of domestic copper	344,998,679	329,354,398	354,188,374	380,613,404	460,061,430
Imports:					
Fine copper in ore, entered for consumption	7,669,978	7,256,015	4,804,614	[a] 5,300,000	[a] 5,900,000
Fine copper in regulus, entered for consumption	303,087	3,175,559	5,873,820		
Bars and ingots	22,097	554,348	606,415	7,979,322	11,397,272
Old copper	71,485	59,375	160,592	1,336,901	
Total	353,065,326	340,399,695	365,633,815	395,229,627	477,358,702
Exports.					
Ingots and bars	30,515,736	138,984,128	162,393,000	121,328,390	259,223,924
Estimated fine copper contents of matte	66,000,000	50,000,000	5,750,000	15,200,000	22,881,936
Total	96,515,736	188,984,128	168,143,000	136,528,390	282,105,860
Available supply	256,549,590	151,415,567	197,490,815	258,701,237	195,252,842

[a] Estimated.

Supply of copper for the United States, from 1892 to 1901, inclusive—Continued.

[Pounds.]

Source.	1897.	1898.	1899.	1900.	1901.
Production of domestic copper	494,078,274	526,512,987	568,666,921	606,117,166	602,072,519
Imports:					
Fine copper in ore, entered for consumption	[a] 12,000,000	[a] 19,750,000	[a] 23,800,000	[a] 36,380,000	[a] 64,000,000
Fine copper in regulus, entered for consumption					
Bars, ingots, and old copper	16,578,420	54,166,467	71,922,340	68,796,808	73,826,406
Total	522,656,694	600,429,454	664,389,261	711,293,974	739,898,925
Exports:					
Ingots and bars—					
Domestic	277,255,742	291,955,905	246,826,331	338 121,071	194,249,828
Foreign	406,598	23,647,968	2,550,149	1,281,782	12,888,083
Estimated fine copper contents of matte	[a] 11,000,000	[a] 5,420,000	[a] 3,500,000	9,000,000	15,000,000
Total	288,662,340	321,023,873	252,876,480	348,402,853	222,137,911
Available supply	233,994,354	279,405,581	411,512,781	362,891,121	517,761,014

[a] Estimated.

STOCKS.

Very complete reports of the stocks of copper on hand have been obtained. In the three great districts, the Lake, Montana, and Arizona, only two large producers of Lake Superior failed to forward figures. Out of the total production in 1901 of 602,072.519 pounds of copper, mining companies representing an output in 1901 of 404,400,805 pounds reported that their stocks were 151,183,982 pounds on January 1, 1901, and were 282,028,828 pounds on January 1, 1902. Producers in other States and Territories, who made 38,667,463 pounds of fine copper, reported an increase in their stock from 870,704 pounds to 1,160,216 pounds, thus showing a total accumulation of copper of 131.134,358 pounds. This does not, as stated, include the stock of two leading lake mines, nor does it include the accumulations of custom smelters and refiners, who handle practically all of the product not accounted for in the totals given. There was on hand on January 1 a quantity in excess of 283,189,044 pounds reported, although it is likely that the stocks of the concerns which declined to submit their figures were not large. However, it is probably safe to state that the stock of the metal in the United States on January 1, 1902, was at least 300,000,000 pounds, equivalent to six months' production. In the absence of figures which might be said to represent normal years, it is impossible to do more than make a guess at what might be considered the excess over a reasonable stock. It is probably fair to assume that, even at the beginning of the year 1901, the stocks of copper in this country were beyond the working limit.

CONSUMPTION.

The data submitted, subject as they are in a number of respects to the limitations which the estimates impose, do justify some conclusions as to the consumption of copper in the United States, the estimate for the years 1900 and 1901 being as follows:

Estimated consumption of copper in the United States in 1900 and 1901.

[Pounds.]

	1900.	1901.
Available supply	362,891,121	517,761,014
Deduct increase in stocks in first hands	6,000,000	135,000,000
Estimated consumption	356,891,121	382,761,014

This of course ignores the decrease in the stocks in second hands, which has been admittedly large, since throughout the period of high prices, particularly in the face of rapidly falling exports, manufacturers and consumers in the United States allowed not only the supply of raw material at the works, the refined copper itself, to fall to the lowest possible limit, but also kept down the quantity of material in process of manufacture.

PRICES.

The following table summarizes the highest and lowest prices obtained for lake copper yearly in the New York markets from 1860 to 1895:

Highest and lowest prices of Lake Superior ingot copper, by years, from 1860 to 1895, inclusive.

[Cents per pound.]

Year.	Highest.	Lowest.	Year.	Highest.	Lowest.
1860	24	19¾	1878	17⅝	15½
1861	27	17½	1879	21¾	15½
1862	32⅞	20¾	1880	25	18½
1863	38½	29	1881	20⅜	16
1864	55	39	1882	20⅜	17⅞
1865	50½	28	1883	18⅛	44⅞
1866	42	26½	1884	15	11
1867	29¼	21½	1885	11½	9⅘
1868	24½	21½	1886	12⅛	10
1869	26½	21⅞	1887	17¾	9 19/20
1870	23⅜	19	1888	17 4/10	15^{17}
1871	27	21¼	1889	17½	11
1872	44	27⅛	1890	17¼	14
1873	35	21	1891	15	10¼
1874	25	19	1892	12⅜	10⅛
1875	23⅞	21½	1893	12⅛	9⅜
1876	23¼	18¾	1894	10¼	9
1877	20½	17½	1895	12¾	9¼

The following table shows the highest and lowest prices monthly during the last six years:

Highest and lowest prices of Lake Superior ingot copper, by months, from 1896 to 1901, inclusive.

[Cents per pound.]

Year.	January.		February.		March.		April.		May.		June.	
	Highest.	Lowest.	Highest.	Lowest.	Highest.	Lowest.	Highest.	Lowest.	Highest.	Lowest.	Highest.	Lowest.
1896	10¼	9¾	11¼	10	11½	10⅞	11	10¾	11½	10⅞	11¾	11½
1897	12	11½	12	11⅞	11⅞	11½	11½	11	11⅛	10¾	11⅛	10⅞
1898	11	$10\frac{9}{10}$	11¾	11	12	11⅞	12⅛	11⅞	12⅛	12	11⅞	11¾
1899	17	13¼	18	17	18	17	19½	18	19¼	18½	18½	18
1900	16½	16¼	16½	16	17	16¼	17¼	17	17¼	16½	16½	16¼
1901	17	16¾	17	16⅞	17	16⅞	17	17	17	16⅞	17	16⅞

Year.	July.		August.		September.		October.		November.		December.	
	Highest.	Lowest.	Highest.	Lowest.	Highest.	Lowest.	Highest.	Lowest.	Highest.	Lowest.	Highest.	Lowest.
1896	11¾	11	11⅛	10⅞	10⅞	10⅜	10⅞	10½	11½	10⅞	11½	11¼
1897	11⅛	11	11¼	11	11⅜	11¼	11¼	11	11	10¾	11	10⅞
1898	11¾	11½	12⅛	11⅜	12¼	12⅛	12½	12¼	12¾	12½	12⅞	12⅝
1899	18½	18¼	18½	18¼	18½	18¼	18½	17	17¼	17	17	16½
1900	16½	16⅛	16¾	16½	16⅞	16¾	16⅞	16¾	17	16¾	17	16¾
1901	17	16⅜	16¾	16½	16¾	16½	16⅞	16½	16¾	16¼	16½	12⅞

The following table shows the fluctuations in prices in the English market:

Average values of copper in England from 1890 to 1901, inclusive.

Year.	Chile bars or G. O. B.			Ore, 25 per cent.		Year.	Chile bars or G. O. B			Ore, 25 per cent.	
	Long tons.			*Per unit.*			*Long tons.*			*Per unit.*	
	£	*s.*	*d.*	*s.*	*d.*		£	*s.*	*d.*	*s.*	*d.*
1890	54	5	5	10	7	1896	46	18	1¾	9	1
1891	51	9	8½	9	7	1897	49	2	6¾	9	5
1892	45	12	8¾	8	7	1898	51	16	7¼	10	1⅛
1893	43	15	6¾	8	5	1899	73	13	8½	13	2
1894	40	7	4	7	6½	1900	73	12	6¼	13	1
1895	42	19	7	8	4¼	1901	66	19	8½	12	5

In detail the fluctuations, monthly, of good merchant copper in the English market were as follows in 1895 to 1901, inclusive.

Fluctuations in good merchant copper in England in 1895 to 1901, inclusive.

[Per long ton.]

Month.	1895.			1896.			1897.			1898.			1899.			1900.			1901.		
	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.
January	40	13	9¾	41	13	8¼	50	10	8¼	48	19	2	62	18	1½	70	14	2	71	17	0
February	39	14	3¾	44	16	11¼	51	6	6	49	12	8¼	72	16	0	74	4	9	71	5	4
March	39	1	9½	45	8	0¾	50	4	0¼	50	13	2½	69	1	0¼	78	0	4	69	13	2
April	40	3	6¾	45	3	2¼	48	16	9	51	14	2½	74	10	0¾	78	7	1	69	14	10
May	43	0	0	46	6	6	48	10	11½	51	9	9¾	77	5	11	74	1	8	69	15	7
June	42	15	6¼	48	18	0	49	1	1½	50	8	0	76	2	0½	71	14	3	68	18	9
July	44	0	2½	49	3	7¾	48	1	0¼	50	3	1	76	19	3½	72	11	5	67	14	8
August	46	13	2½	47	16	9¾	48	12	10¼	51	10	7½	76	4	7¼	73	12	5	66	9	0
September	46	15	7½	47	18	7½	49	8	5	52	2	8¾	76	15	7	73	4	11½	66	2	0
October	46	4	10	47	11	7	48	10	3	53	8	2	75	3	10¼	72	7	7¼	64	4	7
November	43	16	3¾	49	3	11	48	0	11½	55	18	8¼	74	8	5½	72	9	3¾	65	12	2
December	42	15	11	48	16	9¾	48	7	0¼	55	18	11¼	71	19	8	72	2	3½	52	9	3

THE COPPER MARKET IN 1901.

The copper market opened rather dull at the official price of 17 cents for Lake and 16½ cents for electrolytic, but actual sales were made at 16⅞ for Lake and at 16¼ cents for electrolytic. The one event of the month was the reported sale of about 10.000.000 pounds of electrolytic copper to home consumers. There was a somewhat larger business in February, with a firmer tone, but the market became dull again in March. During this time there was a brief struggle over the question of handling the sale of the copper produced by the American Smelting and Refining Company, an arrangement being finally made with the United Metals Selling Company, which also markets the product of the Amalgamated Copper Company and of other mines. The home market was fairly active and firm during April, but was quieter in May and June, the official price continuing 17 cents for Lake copper. In July, however, it was reduced to 16½ cents for Lake and 16⅜ cents for electrolytic copper, consumers persisting in holding off and buying only for near-by delivery. The steady decline in the London market, in spite of support from powerful interests, and the falling off in exports, indicating a restricted consumption abroad, proved a warning to manufacturers. In September a leading Lake company effected the sale of its product to consumers for two months at 16½ cents, but it was coupled with a guaranty against a decline during the life of the contract. The market was in an unsettled condition, but values for the metal were well held for such relatively small quantities as consumers were found to purchase. November brought the announcement on the part of buyers of copper furnace material that settlements would no longer be made at the price prevailing on the day of assay, but at the price ruling ninety and in some cases sixty days subsequent to that date. Sales of large quantities of copper, estimated at 25,000 short tons, were made at 16⅝ cents for electrolytic, with a guaranty against a decline to consumers in this country, and large forward sales were also made in London and on the Continent. At the same time a large wire manufacturer, controlling copper mines, announced a reduction in the price of wire from 18¾ to 17 cents.

In the middle of December the crumbling of values came, the first cut being to 15⅜ cents for Lake and 15 cents for electrolytic copper. On the 18th of December the official price was reduced to 14 cents for Lake and 13⅞ cents for electrolytic copper, and soon after to 13 cents for Lake and 12⅞ cents for electrolytic. At the close of the year Lake copper was selling at 12⅞. The 6th of January brought a further reduction to 12⅛ cents, and the struggle culminated on the 13th of January with an official price of 11⅛ cents for Lake copper.

THE ENGLISH COPPER TRADE.

Since England is one of the leading copper markets of the world, the following tables, showing the import and export movement, are of great interest:

British imports and exports of copper.

[Long tons.]

Year.	Imports of—		Total imports.	Exports.	Apparent English consumption.
	Bars, cakes, and ingots.	Copper in ores and furnace products.			
1890	[a] 49,461	91,788	141,249	89,747	66,170
1891	44,213	94,403	138,616	76,056	59,223
1892	[b] 35,015	99,356	134,371	82,542	[c] 48,367
1893	41,829	88,003	129,832	70,986	66,817
1894	56,157	68,851	125,008	54,689	[d] 50,330
1895	42,135	77,806	119,941	65,990	[d] 50,692
1896	60,458	75,398	135,856	59,334	[d] 76,036
1897	60,428	76,127	136,555	56,542	[d] 69,787
1898	67,978	71,726	139,704	63,370	[d] 69,284
1899	58,880	82,730	141,610	75,271	[d] 60,877
1900	70,247	84,694	154,941	56,997	[d] 81,896
1901	66,764	82,814	149,578	70,396	70,178

[a] Including 3,501 tons of Chile bars transferred from France to England.

[b] Including 3,585 tons of Chile bars transferred from France to England.

[c] Add 4,001 tons for comparison with former years, the difference arising from the new method of making up stock.

[d] Deducting copper contents of sulphate exported (13,078 tons in 1898, 10,045 tons in 1899, 10,728 tons in 1900, and 9,004 tons in 1901).

The following figures for the years from 1896 to 1901, both inclusive, taken from the board of trade returns, supplemented by Messrs. James Lewis & Son, of Liverpool, show in detail the form in which the copper is brought into Great Britain:

Imports of copper into Great Britain from 1896 to 1901, inclusive.

[Long tons.]

Character.	1896.	1897.	1898.	1899.	1900.	1901.
Pure in pyrites	14,726	15,576	16,626	17,529	18,519	16,339
Pure in precipitate	23,160	25,932	21,558	24,387	23,462	22,037
Pure in ore	12,499	11,980	14,576	19,514	17,886	16,683
Pure in matte	25,013	22,639	18,966	21,300	24,827	27,755
Bars, cakes, etc	60,458	60,428	67,978	58,880	70,247	66,764
Total	135,856	136,555	139,704	141,610	154,941	149,578

Messrs. James Lewis & Son, of Liverpool, estimate as follows the imports of copper product into Liverpool, Swansea, and London, which does not, however, include the imports of precipitate into certain outports like Newcastle and Cardiff, estimated in recent years at about 6,000 tons:

Imports of copper product into Liverpool, Swansea, and London, 1896 to 1901, inclusive.

[Long tons.]

Country.	1896.	1897.	1898.	1899.	1900.	1901.
Chile	15,923	14,982	17,734	19,752	19,875	24,624
United States	39,676	32,792	38,979	20,773	32,256	21,426
Spain and Portugal	6,298	7,697	7,293	7,084	9,721	7,780
Spain and Portugal (precipitate)	11,474	17,386	15,664	16,847	17,028	16,554
Spain and Portugal (pyrites)	14,726	15,576	16,626	17,529	18,519	16,339
Australasia	10,635	10,218	13,409	17,085	19,977	20,586
Cape of Good Hope	5,905	7,575	9,381	7,076	8,927	8,284
Venezuela	107	21	....	....	....	....
Japan	3,492	3,654	2,086	7,812	6,763	7,820
Italy	418	100	177	157	119	20
Norway	528	130	....	182	679	728
Canada	....	127	....	10	25	....
Newfoundland	2,467	2,484	1,359	2,044	1,589	1,669
Mexico	7,792	6,217	4,888	5,679	8,781	8,268
Peru	741	998	3,041	5,163	8,220	9,512
Plata River	94	190	124	63	73	84
Other countries	797	1,613	1,807	8,232	3,633	4,756
Total for fine	121,073	121,760	132,568	135,488	156,185	148,250

The quantities of copper in different forms imported into Great Britain and France from the United States are given in the following table:

Imports of copper into England and France from the United States from 1888 to 1901, inclusive.

[Long tons.]

Country.	1888.	1889.	1890.	1891.	1892.	1893.	1894.
England:							
Ore	298	349	5	4	18	23	5
Matte	20,752	26,581	18,897	19,109	24,668	20,700	2,133
Bars and ingots	4,680	3,799	1,269	7,007	1,427	14,924	28,357
Total	25,730	30,729	20,171	26,120	26,113	35,647	30,495
France	6,496	1,058	1,733	8,329	4,340	12,483	9,248
United States into England and France	32,226	31,787	21,904	34,449	30,453	48,130	39,743
Chile into England and France	32,947	22,020	24,641	18,820	19,840	19,717	20,783

Country.	1895.	1896.	1897.	1898.	1899.	1900.	1901.
England:							
Matte	8,337	10,016	5,259	2,181	354	2,767	6,299
Bars and ingots	12,250	29,780	27,591	36,790	20,739	29,267	15,112
Total	20,587	39,796	32,850	38,971	21,093	32,034	21,411
France	11,806	21,998	26,165	22,753	24,695	29,100	14,008
United States into England and France	32,393	61,794	59,015	61,724	45,788	61,134	35,419
Chile into England and France	22,161	22,593	20,842	24,303	25,482	30,912	28,688

It will be noted that a considerable increase in the copper contents of matte imported into England is credited to this country. It is, of course, impossible to state how much of it was really of domestic production. The sharp decline in the imports of bars and ingots reflects the decreased consumption of Great Britain.

The exports of copper from Great Britain estimating the fine contents of alloys, have been as follows:

Exports of copper from Great Britain from 1896 to 1901, inclusive.

[Long tons.]

Character.	1896.	1897.	1898.	1899.	1900.	1901.
English, wrought and unwrought, and sheets	38,734	35,951	40,223	42,992	28,632	37,753
Yellow metal, at 60 per cent	6,773	6,609	6,172	4,156	5,279	5,497
Brass, at 70 per cent	4,172	3,936	3,733	3,994	4,224	4,072
Sulphate of copper	13,155	14,844	13,078	10,045	10,728	9,004
Total	62,834	61,340	63,206	61,187	48,863	56,326
Fine foreign	9,655	10,046	13,242	24,129	18,862	23,074
Total	72,489	71,386	76,448	85,316	67,725	79,400

GERMANY.

One of the most important factors in the world's copper markets during 1901 has been the abrupt decline in the consumption of copper in Germany, which before that time had exhibited a remarkably regular and rapid development. Aron Hirsch & Sohn, of Halberstadt, one of the leading firms of metal merchants in Europe, have compiled the following figures, their annual review exhibiting great care and discrimination:

Copper consumption of Germany from 1894 to 1901, inclusive.

[Metric tons.]

	1894.	1895.	1896.	1897.	1898.	1899.	1900.	1901.
Imports	52,504	59,742	73,123	82,903	89,772	89,746	106,620	78,538
Exports	10,406	10,893	12,452	12,568	14,957	20,304	15,618	14,825
Excess of imports	42,098	48,849	60,671	70,335	74,815	69,442	91,002	63,713
Production	25,857	26,013	29,489	29,468	30,704	37,676	32,423	30,335
Total	67,955	74,862	90,160	99,803	105,519	107,118	123,425	94,048
Copper contents of imported copper ore and iron pyrites	5,000	4,500	5,000	3,500	4,000	4,500	6,500	4,500
Home consumption	62,955	70,362	85,160	96,303	101,519	102,618	116,900	89,548

The authority quoted above estimates the distribution of the consumption, by manufacturers' requirements, as follows:

Consumption, by manufacturers' requirements, 1900 and 1901.

[Metric tons.]

Use specified.	1900.	1901.
Electrical works	43,000	28,000
Copper rolling mills, (rods and sheets)	18,000	16,000
Brass rolling mills and wire works	35,000	30,000
Chemical works, inclusive of blue vitriol	2,000	2,000
Shipyards, railroads, for castings, alloys, German silver, etc	19,000	18,000
Total	117,000	94,000

Aron Hirsch & Sohn estimate the consumption of old material in Germany at 15,000 to 20,000 tons annually.

The Imperial Statistical Bureau is very careful to trace the source of the bars and ingots imported into Germany. This fact is particularly interesting because it furnishes data which our export statistics fail to show, since necessarily they report shipments to Holland which are really in transit into Germany. Of course these figures do not include the imports of copper in the form of copper coins and old material, 4,535 metric tons copper content in 1901; nor that in the form of brass, 1,139 metric tons; nor in the form of ores, 2,537 tons; nor in the form of pyrites, 11,707 tons:

Source of German imports of ingot copper.

[Metric tons.]

Country.	1894.	1895.	1896.	1897.	1898.	1899.	1900.	1901.
Free port (Hamburg)	1,689	1,185	2,371	2,669	2,873	2,496	2,222	1,899
Belgium	356	356	115	9	216	19	177	29
France	303	152	81	268	121	93	87	149
Norway	128	362	71	45	32	1	11	9
Austria-Hungary	50	197	11	9	12	105	224	124
Sweden	33	83	198	250	328	215	161	10
Switzerland	....	....	5	6	2	1	1	6
Spain	10	....	10	41	69	31	446	1,164
England	7,430	7.363	7,478	8,660	12,754	14,350	9,545	7,653
Netherlands	109	139	73	18	19	184	216	34
United States	23,795	31,311	42,504	50,420	52,473	47,742	66,264	42,422
Japan	2,072	1,932	1,916	2,655	2,196	3,050	2,377	3,158
Chile	884	825	827	2,217	1,216	1,187	1,016	931
Australasia	....	313	183	259	742	581	593	948
Other countries	173	147	271	46	25	39	162	84
Total	37,032	44,365	56,114	67,572	73,078	70,094	83,502	58,620

Of course the quantities of copper credited to England are drawn from the principal producing countries. It is impossible to state whether and to what extent the United States participates in them.

The production of copper in Germany for a series of years is shown in the table below. It should be noted that outside of the Mansfeld company, which is separately given, the production of copper from German mines is small, the mines at Stadtberge contributing 780 tons of it. By far the greater part of the difference between the total figures and those representing Mansfeld is product obtained at German metallurgical works from the treatment of foreign ores and furnace materials. The figures are interesting as showing the extent of the pyrites extracting and copper smelting industry of Germany.

Copper production of Germany.

[Metric tons.]

Year.	Total production.	Production of Mansfeld.	Year.	Total production.	Production of Mansfeld.
1891	24,688	15,365	1897	29,468	18,248
1892	25,406	15,588	1898	30,704	18,335
1893	24,011	14,358	1899	37,676	21,116
1894	25,857	15,217	1900	32,423	18,675
1895	26,013	15,083	1901	31,950	19,079
1896	29,489	18,541			

The Mansfeld figures, with the exception of 1901, are from the annual reports.

The export statistics of Germany are particularly interesting because that country has become an important factor in the world's markets. It will be observed from the following table that since 1893 the first decline has occurred in 1901:

Exports of copper manufactures from 1893 to 1901, inclusive.

[Metric tons.]

Products.	1893.	1894.	1895.	1896.	1897.	1898.	1899.	1900.	1901.
Rods and sheets	4,889	5,009	4,700	5,429	5,712	5,369	4,869	5,270	4,951
Wire	3,052	4,433	3,975	5,909	6,175	5,930	7,578	9,604	7,832
Cables	1,957	2,193	3,713	7,631	8,119	10,432	11,481	15,444	13,902
Miscellaneous	563	501	556	279	245	263	243	212	195
Coarse forgings	2,050	2,538	2,643	2,648	2,703	2,988	3,162	3,174	3,087
Cartridges, caps, etc	3,682	3,376	4,450	4,156	2,712	3,288	2,682	1,731	1,880
Fine copper goods	3,859	4,117	4,912	7,837	7,425	8,454	9,855	11,177	10,018
Perforated sheets and netting	....	....	....	....	....	275	306	327	375
Total	20,052	22,167	24,949	33,889	33,091	36,999	40,176	46,939	42,240
Less imports	1,828	1,778	1,892	2,301	1,606	2,449	2,811	3,073	2,680
Net exports	18,224	20,389	23,057	31,588	31,485	34,550	37,365	43,866	39,560

THE FRENCH COPPER TRADE.

Fourth in the list of the greater copper-consuming countries is France, which apparently showed a heavy decline in 1901.

According to the French official statistics, the imports of bars, ingots, etc., have been as follows:

Imports and exports of bar and ingot copper into France.

[Metric tons.]

Source.	1895.	1896.	1897.	1898.	1899.	1900.	1901.
England	8,250	5,596	3,884	5,970	8,650	3,289	5,400
Chile	3,494	4,573	2,804	4,469	4,442	3,509	2,690
United States	11,157	21,279	28,118	26,210	24,470	33,187	22,001
Other countries	11,717	12,197	14,830	10,712	13,650	14,246	14,318
Total	34,618	43,645	49,636	47,361	51,212	54,231	44,409
Less exports	4,910	5,144	4,766	5,458	8,285	7,651	7,510
Net imports	29,708	38,501	44,870	41,903	42,927	46,580	36,899

In order to arrive at the consumption, it is necessary to add the net imports of old material and the copper contents of foreign ores and pyrites, and to account for fluctuations in stocks. The following table summarizes the results:

Copper consumption of France.

[Metric tons.]

	1894.	1895.	1896.	1897.	1898.	1899.	1900.	1901.
Net imports, raw material	25,743	34,352	44,026	50,060	48,060	49,667	54,862	40,214
Contents of ore	4,635	6,074	5,570	8,685	7,024	6,004	7,976	5,000
Total	30,378	40,426	49,596	58,745	55,084	55,671	62,838	45,214
Increase (+) or decrease (−) of stocks	+1,459	−103	−589	−379	−515	+670	−1,006	+966
Consumption	31,837	40,323	49,007	58,366	54,569	56,341	61,832	46,180

OTHER COUNTRIES.

The home consumption of Austria-Hungary is figured at 21,016 metric tons in 1901, as compared with 22,704 tons in 1900.

For Russia the figures for 1901 are not yet available. For 1900 the estimate is 18,179 tons, including 6,939 tons of domestic production. In 1899 the consumption was slightly larger, being 19,545 tons, with the Russian copper product placed at 6,941 tons.

THE WORLD'S PRODUCTION.

Messrs. Henry R. Merton & Co., of London, have compiled the following statement of the world's production, the figures being modified by this office where official statistics are available:

The copper production of the world, 1895 to 1901, inclusive.

[Long tons.]

Country.	1895.	1896.	1897.	1898.	1899.	1900.	1901.
EUROPE.							
Great Britain	580	555	555	640	635	777	[a]600
Spain and Portugal:							
Rio Tinto	32,985	34,501	33,923	33,705	34,370	35,732	35,348
Tharsis	12,000	12,000	[a]11,000	[a]11,150	9,448	7,965	7,427
Mason and Barry	[a]4,100	[a]3,900	[a]4,300	3,600	3,600	3,460	3,729
Sevilla	1,050	1,025	810	800	1,200	1,460	1,292
Other mines	4,300	3,400	3,050	3,120	3,550	4,255	5,825
Germany:							
Mansfeld	14,860	18,265	17,960	18,045	20,785	18,390	18,780
Other German	1,695	1,800	2,185	2,040	2,675	2,020	2,940
Austria	869	1,065	1,210	1,110	915	865	1,015
Hungary	239	205	445	430	590	490	335
Sweden	203	500	545	480	520	450	320
Norway	2,685	2,500	3,450	3,615	3,610	3,935	3,375
Italy	2,236	3,400	3,480	2,965	3,032	2,797	[a]3,000
Russia	5,326	5,832	6,941	7,291	7,533	8,100	[a]8,000
Turkey	....	....	975	470	920	520	980
Total	83,128	88,948	90,829	89,461	93,383	91,216	92,966
NORTH AMERICA.							
United States	169,917	205,384	220,571	235,050	253,870	270,588	268,782
Canada	3,923	4,190	5,938	8,040	6,731	8,446	18,496
Newfoundland	1,800	1,800	1,800	2,100	2,700	2,700	2,336

[a] Estimated.

The copper production of the world, 1895 to 1901, inclusive—Continued.

[Long tons.]

Country.	1895.	1896.	1897.	1898.	1899.	1900.	1901.
NORTH AMERICA—cont'd.							
Mexico:							
Boleo	10,450	9,940	10,170	9,435	10,335	11,050	10,795
Other Mexican	1,170	1,210	[a]4,200	[a]7,000	[a]9,000	[a]11,000	[a]13,000
Total	187,260	222,524	242,679	261,625	282,636	303,784	[a]313,409
SOUTH AMERICA.							
Chile	22,075	23,500	21,900	24,850	25,000	25,700	30,000
Bolivia:							
Corocoro	2,250	2,000	2,200	2,050	2,500	2,100	[a]2,000
Peru	450	740	1,000	3,040	5,165	8,220	9,520
Argentina	150	100	200	125	65	75	780
Total	24,925	26,340	25,300	30,065	32,730	36,095	42,300
AFRICA.							
Algiers	35	....	....	50	....	....	....
Cape of Good Hope:							
Cape Company	5,350	5,470	5,290	4,660	4,140	4,420	5,072
Namaqua Company	1,730	1,980	2,150	2,400	2,350	2,300	2,400
Total	7,115	7,450	7,440	7,110	6,490	6,720	7,472
ASIA.							
Japan	18,430	21,000	23,000	25,175	27,560	28,121	27,475
AUSTRALASIA.							
New South Wales	3,322	4,467	6,922	5,743	5,394	[a]5,500	[a]6,000
South Australia	5,251	4,877	4,705	5,000	[a]6,500	[a]5,386	[a]7,120
Tasmania	....	1,928	4,956	5,200	[a]9,000	[a]10,000	[a]12,000
Queensland	....	....	....	....	....	384	3,061
Total	8,573	11,272	16,583	15,943	20,894	21,270	28,181

[a] Estimated.

RECAPITULATION.

Country.	1890.	1891.	1892.	1893.	1894.	1895.
Europe	79,952	80,751	84,648	82,922	82,474	83,128
North America	124,711	138,065	166,941	158,553	172,994	187,260
South America	33,960	29,015	29,015	27,320	26,810	24,925
Africa	6,570	6,120	6,120	6,090	6,500	7,115
Asia	17,972	18,500	19,000	18,000	20,050	18,430
Australasia	9,455	10,292	8,785	6,158	6,791	8,573
Total	272,620	282,743	314,509	299,043	315,619	329,431

Country.	1896.	1897.	1898.	1899.	1900.	1901.
Europe	88,948	90,829	89,461	93,383	91,216	92,966
North America	222,524	242,679	261,625	282,636	303,784	313,409
South America	26,340	25,300	30,065	32,730	36,095	42,300
Africa	7,450	7,440	7,110	6,490	6,720	7,472
Asia	21,000	23,000	25,175	27,560	28,121	27,475
Australasia	11,272	16,583	15,943	20,894	21,270	28,181
Total	377,534	405,831	429,379	463,693	487,206	511,803

FOREIGN PRODUCERS.

SPAIN.

The production of the Rio Tinto Company has been practically the same in 1901 as it was in 1900. There were extracted 1,928,776 long tons of pyrites, with an average copper content of 2.627 per cent, as compared with 1,894,504 tons, with 2.744 copper content, in 1900. Of this, there were shipped 522,252 tons of pyrites, with 2.68 per cent of copper content, and 119,683 tons of sulphur ore, with an average of 1.025 per cent of copper. Of the ore extracted, 1,294,827 tons were put down for local treatment, there being produced by treatment at the mines 21,100 tons, the copper contents of the pyrites shipped being 14,248 tons. The quantities brought to market were 19,363 tons of refined copper (the company having a plant at Carnarvon, in Wales)—974 tons of copper in sulphate and 14,267 tons in pyrites, a total of 34,604 tons, as compared with 34,631 tons in 1900. The estimated copper contents of the reserve heaps is 136,457 long tons of fine copper, which are carried on the books at the valuation of £4 6s. 10d. During 1901 the company put up a Bessemer plant in Spain, which went into operation in November, so that in the future blister copper and not matte will be shipped.

The year 1901 was not quite so profitable as previous years, the revenue account showing a profit, including balance of £22,174 carried forward from 1900, of £1,505,693. There was written off £9,689 as a fixed charge on pyrites, £10,000 on overburden account, £65,800 for the redemption of 4 per cent mortgage bonds, £78,454 for plant gone out of use, £10,000 for a coal exploration in Spain which proved a failure, £8,500 for depreciation of securities, £40,000 to reserve fund (now £400,000), and £4,000 to the provident fund, leaving available £1,279,250. Out of this, 5s. per share was paid on the preferred stock, and 7s. 6d. on the common stock, which absorbed, free of income tax, £1,254,805, leaving a balance of £24,445. The share capital is £1,625,000 of 5 per cent preference shares and a like sum of common stock. There are outstanding £3,241,640 of 4 per cent first-mortgage bonds.

The Tharsis Sulphur and Copper Company made a profit of £323,734, to which £26,905 for interest was added, making a total income of £350,639. Deducting £44,801 for management, and £42,160 for depreciation of properties and plant, there was left a net profit of £263,678. Dividends amounting to £250,000 were paid. The production of the mines continues to decline, the total amount of ore extracted in 1901 having been 400,162 tons, as compared with 468,738 tons in 1900. The shipments of pyrites fell of from 398,106 long tons in 1900 to 371,412 in 1901, and the shipments of copper precipitate from 6,774 long tons in 1900 to 6,133 tons in 1901. The total amount of refined copper made was 7,967 long tons in 1900 and 7,427 long tons in 1901, the decrease being due to the smaller production of copper precipitate at the Tharsis mines proper. The company has acquired a mine in Norway in order to increase the production of copper.

Mason & Barry, Limited, the third of the famous pyrites companies of the Peninsula, made a profit of £122,539, out of which dividends aggregating £120,362 were paid. The annual report states that the total quantity of ore raised during 1901 was 129,314 tons, against 117,714 tons in 1900. The shipments, inclusive of ore from the cementation works, amounted to 449,760 and 394,740 tons, respectively. The mines are approaching exhaustion.

MEXICO.

By far the most important of the new mines which have entered the world's markets in recent years is that of the Greene Consolidated Copper Company, whose properties are located at Cananea, Sonora. A smelting plant has been constructed containing 5 furnaces, to which 3 more are being added. Converters have also been built, and the production of copper has been rapidly expanded, until in May, 1902, the new mine shipped about 7,000,000 pounds of 45 per cent copper matte. There is every reason to believe that before the close of the current year the production will reach 4,500,000 to 5,000,000 pounds of fine copper per month. Such a rapid development has never before been witnessed in the copper-mining industry.

The Boleo Company, of southern California, in 1901 produced 10,956 metric tons of fine copper, as compared with 11,297 metric tons in 1900, from 275,635 and 261,170 tons of ore, respectively. The net profit for the year was 1,206,502 francs, after paying for improvements and machinery 1,744,235 francs, writing off for depreciation 208,844 francs, and charging for sinking and reserve funds 1,191,925 francs.

CANADA.

The copper production of Canada showed a marked increase in 1901. According to the estimate of Mr. E. D. Ingall, of the department of mines, the yield was 40,951,196 pounds fine. This compares with 18,919,820 pounds in 1900. The greater part of this product was from the mines of British Columbia, which, from the report of Mr. William F. Robertson, provincial mineralogist, produced 30,736,798 pounds in 1901 as compared with 9,997,080 pounds in 1900. The increase must be credited chiefly to the Boundary Creek or Yale district, and from the preparations under way, it is probable that an even larger output will be reached in the near future.

The principal smelters are those of the Granby Company at Great

Forks and of the British Columbia Copper Company at Greenwood. The former has added two furnaces and a converting plant, while the latter is erecting a second furnace. The Montreal and Boston Copper Company, of Philadelphia, has purchased the plant near Boundary Falls, built by the Standard Pyritic Smelting Company.

Two smelters are in process of construction on Vancouver Island, the first at Crofton and a smaller one at Ladysmith. Both are to be supplied with ore from the the Mount Sicker district, the former from the Lenora and the latter from the Tyee mine.

AFRICA.

The Cape Copper Company, Limited, owns the Ookiep and Nababeep mines in South Africa, the Tilt Cove mines in Newfoundland, and the Briton Ferry Smelting Works in England. The company produced 5,072 tons of fine copper from all sources, and made a profit of £248,895.

TASMANIA.

In Tasmania the Mount Lyall Mining and Railway Company, Limited, has continued the principal producer. During the year ending March 31, 1902, the company treated 272,310 long tons of ore from its own mines and 72,003 tons of purchased ores, producing 10,113 long tons of copper, 656,904 ounces of silver, and 21,057 ounces of gold. A very considerable part of the purchased ore came from the North Lyall, which averaged 7½ per cent of copper, so that the grade of the Lyall ore must be low. It appears also that the explorations have not developed any new bodies of rich ore, so that the reserves are being steadily drawn upon. The net profit during the half year ending March 31, 1902, was £56,862, comparing with £128,575 for the half year ending September 30, 1901, and £126,058 for the half year ending March 31, 1901.

The North Mount Lyall Copper Company promises to fill whatever gap in the production may be due to the falling off of the older Lyall Company. The company has been engaged in building a railroad of its own and in erecting a concentrating and smelting plant at Crotty, where it is expected the product will reach 7,500 long tons of fine copper per annum. In the interval the company has been exporting high-grade ores to Europe and to this country, having shipped to London 12,494 tons, averaging 17.33 per cent of copper. The company has also, under a contract with the Mount Lyall Company covering 50,000 tons, delivered locally 44,249 tons of 7½ per cent ore. Notwithstanding the handicap of an unfinished railway and no smelting facilities, the company earned from sales and shipments of crude ore £222,475, on which the net profit, after providing for cost of production, working expenses, administration, and debenture interest, was £102,970.

PERU.

The copper production of Peru has increased materially in recent years through the shipments of selected ores from the Cerro de Pasco district. Leading capitalists identified with the copper industry of the United States have acquired interests in the mines, and development on a large scale will probably render Peru one of the great contributors to the world's supply of copper.

LEAD.

By Charles Kirchhoff.

INTRODUCTION.

The production of lead in the United States in 1901 was fully up to the high total which was attained in the year 1900, although the output of individual districts varied somewhat. On the whole, the Mississippi Valley has steadily forged ahead. Based on disseminated nonargentiferous ores, the development of new properties in southeast Missouri requires time and a considerable outlay of capital. It is therefore safe to state, from the present aspect of affairs, that a further increase in that district is assured.

The production of 1901 was large, and there is ample proof in the statistics that consumption was not quite able to cope with it, there having been a considerable accumulation of stock in first hands, which indicates that prices have been held rather above the safe level.

PRODUCTION.

The following series of tables present the figures of the total gross production of lead in the United States from 1825. Up to the year 1882 the figures have been compiled from the best data available. Since 1882 the statistics are those collected by this office, with the exception of the year 1889, when they were gathered by the Census Office:

Production of refined lead in the United States from 1825 to 1882, inclusive.

Year.	Production.	Year.	Production.	Year.	Production.
	Short tons.		*Short tons.*		*Short tons.*
1825	1,500	1847	28,000	1865	14,700
1830	8,000	1848	25,000	1866	16,100
1831	7,500	1849	23,500	1867	15,200
1832	10,000	1850	22,000	1868	16,400
1833	11,000	1851	18,500	1869	17,500
1834	12,000	1852	15,700	1870	17,830
1835	13,000	1853	16,800	1871	20,000
1836	15,000	1854	16,500	1872	25,880
1837	13,500	1855	15,800	1873	42,540
1838	15,000	1856	16,000	1874	52,080
1839	17,500	1857	15,800	1875	59,640
1840	17,000	1858	15,300	1876	64,070
1841	20,500	1859	16,400	1877	81,900
1842	24,000	1860	15,600	1878	91,060
1843	25,000	1861	14,100	1879	92,780
1844	26,000	1862	14,200	1880	97,825
1845	30,000	1863	14,800	1881	117,085
1846	28,000	1864	15,300	1882	132,890

The difficulties encountered in arriving at the amount of lead produced by mines in the United States have been fully explained in former reports. They were created by the development of a large industry, first, in smelting foreign lead ores in conjunction with the product of domestic mines, and, second, in desilverizing in bond foreign base bullion. The result of the system, modified to suit changing conditions, for ascertaining the lead product of the mines of the United States, appears in the last column of the following table:

Production of refined lead in the United States from 1883 to 1901, inclusive.

Year.	Total production.[a]	Desilverized lead.[a]	Soft lead.[b]	From foreign ores and base bullion.	Net American product.
	Short tons.	*Short tons.*	*Short tons.*	*Short tons.*	*Short tons.*
1883	143,957	122,157	21,800	....	143,957
1884	139,897	119,965	19,932	....	139,897
1885	129,412	107,437	21,975	....	129,412
1886	135,629	114,829	20,800	[c] 5,000	[c] 130,629
1887	160,700	135,552	25,148	[c] 15,000	[c] 145,700
1888	180,555	151,465	29,090	28,636	151,919
1889	182,967	153,709	29,258	26,570	156,397
1890	161,754	130,403	31,351	18,124	143,630
1891	202,406	171,009	31,397	23,852	178,554
1892	213,262	181,584	31,678	39,957	173,305
1893	229,333	196,820	32,513	65,351	163,982
1894	219,090	181,404	37,686	59,739	[d] 162,686
1895	241,882	201,992	39,890	76,173	[d] 170,000
1896	264,994	221,457	43,537	77,738	[d] 188,000
1897	291,036	247,483	43,553	83,671	[d] 212,000
1898	310,621	267,842	42,779	99,945	[d] 222,000
1899	304,392	263,826	40,566	95,926	[d] 210,500
1900	377,679	329,658	48,021	106,855	270,824
1901	381,688	323,790	57,898	112,422	[d] 270,700

[a] Including foreign base bullion refined in bond.
[b] Including a small quantity of lead produced in the Southern States.
[c] Estimated.
[d] Arrived at from direct returns from smelters.

Hard lead.—Since 1891 special returns from desilverizers have been made on the quantity of antimonial or hard lead produced. The quantity was 4,043 tons in 1891, 5,039 tons in 1892, and 5,013 tons in 1893. In 1896 the production of hard lead was 7,507 tons, rising to 8,867 tons in 1897, and declining again to 8,473 tons in 1898. It amounted to 6,345 tons in 1899, to 9,906 tons in 1900, and to 10,656 tons in 1901.

SOURCES OF LEAD.

Since 1894 this office has collected statistics of the production of lead from domestic sources, territorially distributed, by securing through the courtesy of all the smelting companies returns showing the lead content of the ores treated by them. In the year 1900 the change in the administration of a large number of the concerns made it impossible to secure complete figures. In 1901, however, the returns again cover every establishment, and furnish as accurate a record as is obtainable, since a census of the mines themselves could not possibly yield complete or reliable figures.

Lead content of ores smelted by the works in the United States, by States.

State or Territory.	1894.	1895.	1896.	1897.	1898.	1899.	1900.	1901.
	Short tons.	*Short tons.*	*Short tons.*	*Short tons.*	*Short tons.*	*Short tons.*	*Short tons.*	*Short tons.*
Colorado	50,613	46,984	44,803	40,576	57,352	70,308	82,137	73,265
Idaho	33,308	31,638	46,662	58,627	59,142	52,154	85,444	79,654
Utah	23,190	31,305	35,578	40,537	39,299	29,987	48,044	49,870
Montana	9,637	9,802	11,070	12,930	10,745	10,227	....	5,791
New Mexico	2,973	3,040	3,461	9,123	5,797	4,856	....	1,124
Nevada	2,254	2,583	1,173	959	4,714	3,388	....	1,873
Arizona	1,480	2,053	1,165	2,184	2,224	3,377	....	4,045
California	478	949	691	383	482	487	520	381
Washington, Oregon, Alaska, South Dakota, Texas	150	381	1,006	638	1,349	862	....	1,029
Missouri, Kansas, Wisconsin, Illinois, Iowa, Virginia	46,300	53,596	51,887	56,542	54,469	54,444	....	67,172
Total lead content American ores smelted	170,383	182,331	197,496	222,499	235,573	230,090	....	284,204
Content Mexican ores	[a] 21,000	16,437	15,403	13,430	10,520	10,293	....	11,841
Content Canadian ores		5,040	10,100	19,515	17,377	5,110	....	9,615
Content miscellaneous or unknown	....	....	2,118	344	428	772	....	804

[a] Estimated.

On the basis of these figures the production of lead from ores mined in the United States in 1901 has been estimated at 270,700 short tons, by assuming the yield to have been 94 per cent on the lead in ores and adding the soft lead. The total for Missouri, Kansas, and group is made up of 57,898 net tons of soft lead and of 9,274 tons of lead contained in ores from the same districts smelted by desilverizers.

DOMESTIC PRODUCERS.

In southeast Missouri the principal increase in production, among the older mines, was with the St. Joseph Lead Company and with the Central Lead Company. The latter company has put a new shaft in operation, and has blown in a new furnace. The Desloge Consolidated Lead Company smelts the greater part of its concentrates locally, but it also ships a considerable part to custom smelters. The Columbia Lead Company and the Catherine Lead Company make no pig lead, marketing the concentrates. The Columbia Lead Company built a smelter at Granite City, Ill., but sold it as soon as built to the Markle

Lead Company, of St. Louis, Mo., extensive manufacturers of shot and other manufactures of lead, who have enlarged the plant and work ores from the Joplin district and from Wisconsin. The Federal Lead Company has under construction a new smelting plant at Alton, Ill.

There was an increase in the lead-ore production of the Joplin-Galena district of nearly 6,000 tons, equivalent to over 4,000 tons of pig lead. Of the different camps, Joplin mined 12,227 tons of ore; Carterville, 8,772 tons; Galena, 5,270 tons; Spurgeon and Spring City, 1,833 tons; Duenweg, 1,478 tons, and Granby, 1,075 tons; the total for the district being 34,938 tons, valued at $1,610,981. This was reflected in the production of the local smelters, notably of the Picher Lead Company and of the Granby Mining and Smelting Company. The latter added two Scotch eyes to their smelter, making five, from which, running double turn, it is expected 5,000 tons of pig lead will be produced.

A part of the product of the ore of the Joplin-Galena district is converted by direct process into a pigment.

Some of the ore of the district, as well as that of southeast Missouri and of Wisconsin, is handled by smelters connected with desilverizing plants. In 1901 the quantity of lead thus produced amounted to 9,274 short tons, so that the total output of the Mississippi Valley footed up to about 67,000 short tons, or about one-quarter of the whole production of the country.

It may be noted that in some cases Missouri soft lead is put through the desilverizing process, so that there is some danger of duplication, which has been carefully avoided.

Idaho continues the principal contributor to the lead markets of the country, fully 75,000 tons of the total of 270,700 tons coming from thence. Nearly all of it is the product of the Cœur d'Alene mines, which are splendidly equipped and are capable of even a greater output.

Colorado yielded about 73,000 tons in 1901, Leadville remaining the largest single district, although in 1901 this district furnished less than in former years. The Herald-Democrat, of Leadville, estimates the lead content of the ores of the district in 1901 at 26,120 tons, as compared with 32,664 short tons in 1900. The rest of the lead product of the State comes from many camps, the majority of which are prospering and are increasing in output. The American Smelting and Refining Company is credited with having purchased one of the most important producers, the Silver Lake mines, near Silverton.

There has been some movement toward the establishment of independent smelting plants. Interests in the New Monarch property in the Leadville district are erecting works at Salida, called the Ohio and Colorado Smelting and Refining Company; and at White Pine, Gunnison County, the Southwestern Smelting Company is being established to handle local ores.

The production of Utah has been well maintained. The American Smelting and Refining Company is building a large new plant at Murray, and an important smelting establishment is also being erected by independent parties.

The American Smelting and Refining Company during 1901 rebuilt the works at El Paso, Tex., which had been destroyed by fire. It contains 7 lead furnaces and 3 copper furnaces.

CONSUMPTION.

According to the returns, there were treated in the refineries 88,595 short tons of foreign base bullion. The smelters reported the handling of foreign ores containing 23,827 short tons of lead. This accounts for 112,422 short tons of foreign material.

The records of the Treasury Department make the following exhibit, the monthly details being given in the table published elsewhere.

Official returns of warehouse transactions in lead during 1901.

	Pounds.
In warehouse January 1, 1901	42, 379, 270
Direct importation	221, 030, 779
	263, 410, 049
Deduct in warehouse January 1, 1902	33, 225, 677
	230, 184, 372
Addition by liquidation	592, 977
Total	230, 777, 349

The disposition of this was as follows:

Disposition of lead in warehouses in 1901.

	Pounds.
Exported	194, 199, 419
Withdrawn for consumption	16, 035, 929
Deducted by liquidation	23, 373, 544
Total	233, 608, 892

This shows an excess of 2,831,543 pounds, which is lead in transit, being the difference of lead "entered warehouse from other districts" and "lead withdrawn from warehouse for transportation."

Consumption may therefore be figured as follows:

Estimated consumption of lead in 1901.

		Short tons.
Total production refined lead		381, 688
Stock January 1, 1901		39, 050
Total		420, 738
Deduct:		
Exports foreign lead	97, 100	
Stock January 1, 1902	53, 733	
		150, 833
Apparent home consumption		269, 905

This, it will be observed, is very close to the estimated production of 270,700 short tons, and apparently does not account for the reported increase in the stock of about 14,700 tons. A part of this is accounted for by the diversion of 8,000 tons of foreign lead to domestic consumption, to which must be added a certain quantity of exempt lead covered by the "deduction by liquidation." Of course allowance must be made for variations in the quantities of base bullion, etc., in transit.

The consumption thus figured for 1901, when a complete statement of stocks was first available, may be compared with estimates of previous years, which were made on a somewhat different basis, in some cases with partial data as to stocks and in others without any reliable figures relating to them.

Estimate of the consumption of lead in the United States from 1894 to 1901, inclusive.

	1894.	1895.	1896.	1897.	1898.	1899.	1900.	1901.
Supply—								
	Short tons.	*Short tons.*	*Short tons.*	*Short tons.*	*Short tons.*	*Short tons.*	*Short tons.*	*Short tons.*
Total product desilverized lead	181,404	201,992	221,457	247,483	267,827	263,826	329,658	323,790
Soft lead	37,686	39,890	43,537	43,553	42,779	40,566	48,021	57,898
Imports, foreign refined	8,200	22,947	2,020	2,000	437	215	452	....
Stock, domestic, beginning of year	7,496	8,586	9,557	9,299	17,608	....	....	....
Stock, foreign in bond, beginning of year	3,302	7,181	9,865	4,124	6,691	7,341	11,320	39,050
Total supply	238,088	280,596	286,436	306,459	335,342	311,948	389,451	420,738
Deduct—								
Foreign base bullion and ores refined in bond and exported	29,000	18,130	57,612	62,409	84,666	73,313	97,959	97,100
Lead in manufactures exported under drawback	950	2,000	1.500	500	1,200	1,000	1,000	....
Stock, domestic, close of year	8,586	9,557	9,299	17,608	14,683	....	....	....
Stock, foreign in bond	7,181	9,865	4,124	6,694	7,341	11,320	21,190	53,733
Total	45,717	39,552	72,535	87,211	107,890	85,633	120,149	150,833
Apparent home consumption	192,371	241,044	213,901	219,248	227,452	226,315	269,302	269,905

IMPORTS AND EXPORTS.

In previous volumes of the Mineral Resources tables of imports and exports of lead have been presented which go back to the year 1867, the figures being supplied by the Bureau of Statistics. The following tables supply the data since 1890:

Lead imported and entered for consumption in the United States, 1890 to 1901, inclusive.

Year ending—	Ore and dross.		Pigs and bars.	
	Quantity.	Value.	Quantity.	Value.
December 31—	*Pounds.*		*Pounds.*	
1890	11,065,865	$504,067	19,336,233	$593,671
1891	40,692,478	1,120,067	3,392,562	104,184
1892	54,249,291	1,278,114	1,549,771	110,953
1893	58,487,319	1,004,295	3,959,781	129,290
1894	33,020,250	437,999	39,168,529	895,496
1895	45,050,674	687,222	109,551,082	2,052,209
1896	37,829,583	631,381	10,551,148	191,479
1897	31,036,882	535,094	16,050,987	314,549
1898	16,610,607	331,116	311,502	8,787
1899	6,824,556	125,344	3,473,252	78,062
1900	10,209,742	623,802	3,673,616	76,141
1901	10,324,119	272,396	3,604,157	88,056

Lead imported and entered for consumption in the United States, 1890 to 1901, inclusive.

Year ending—	Sheets, pipe, and shot.		Not otherwise specified.	Total value.
	Quantity.	Value.		
December 31—	*Pounds.*			
1890	91,660	$5,591	$1,136	$1,104,465
1891	334,179	12,406	604	1,237,261
1892	90,135	6,207	2,063	1,397,337
1893	59,798	2,955	1,691	1,138,231
1894	44,080	2,050	536	1,336,081
1895	128,008	5,030	1,277	2,745,738
1896	96,010	3,818	644	827,322
1897	95,891	4,042	513	854,198
1898	242,759	9,389	312	349,604
1899	110,372	4,402	8,626	216,434
1900	27,945	1,393	877	702,213
1901	56,735	2,773	1,234	364,459

Lead, and manufactures of lead, of domestic production, exported, 1890 to 1901, inclusive.

Year ending—	Manufactures of lead.		Pigs, bars, and old.		Total value.
	Quantity.	Value.	Quantity.	Value.	
December 31—	*Pounds.*		*Pounds.*		
1890		$181,030			$181,030
1891		173,887			173,887
1892		154,375			154,375
1893		508,090			508,090
1894		456,753		[a]$41,240	497,993
1895		164,083	1,696,879	50,773	214,856
1896		164,877	[b]16,359,452	442,496	607,373
1897	[c]150,473	[d]49,816	[b]7,725,624	223,037	433,319
		[e]160,466			
1898	[c]265,062	[d]97,862	118,960	4,450	215,239
		[e]112,927			
1899	[c]314,348	[d]115,137	93,115	4,286	273,919
		[e]154,496			
1900	[c]363,600	[d]130,758	1,993,773	88,664	459,571
		[e]240,149			
1901	500,460	178,752	4,787,107	214,842	624,534
		230,940			

[a] Not enumerated between 1868 and July 1, 1894.

[b] Part of this is foreign lead returned by collectors of customs by mistake as domestic lead.

[c] Type.

[d] Value of type.

[e] Value of all other manufactures.

According to the returns of the Treasury Department the sources of imports of lead in the calendar years 1895, 1896, 1897, 1898, 1899, 1900, and 1901 were as follows:

Sources of imports of lead.

Country.	1895.	1896.	1897.
	Pounds.	*Pounds.*	*Pounds.*
United Kingdom	8,161,411	1,365,132	1,120,528
Germany	1,113,148		
Other Europe	36,618,228	1,235,981	1,101,151
Total refined pig lead	45,892,787	2,601,113	2,221,679
British North America	15,860,906	25,672,833	44,171,421
Mexico	138,312,146	130,388,173	137,364,677
Total ore and base bullion	154,173,052	156,061,006	181,536,098
Other countries	931,116	1,656,398	1,560,635
Total imports	200,996,955	160,318,517	185,318,412

Sources of imports of lead—Continued.

Country.	1898.	1899.	1900.	1901.
	Pounds.	*Pounds.*	*Pounds.*	*Pounds.*
United Kingdom	2,326,937	317,321	567,482	402,552
Germany	....	....	225,222	671,294
Other Europe	....	111,952	111,905	2,453
Total refined pig lead	2,326,937	429,273	904,609	1,076,299
British North America	34,453,299	17,871,875	42,139,262	52,130,002
Mexico	142,030,670	173,432,976	178,602,486	163,453,526
Total ore and base bullion	176,483,969	191,304,851	220,741,748	215,583,528
Other countries	480,384	1,142,950	7,147,092	8,282,502
Total imports	179,291,290	192,877,074	228,793,449	224,942,329

The subdivision by groups representing refined pig lead and lead in ore and base bullion is made by this office.

It will be observed that the import statistics of the Treasury Department agree closely with the aggregate of the reports of the smelters and refiners, whose total is 112,422 short tons. According to these reports the lead content of the foreign ores smelted amounted to 21,260 tons, of which 11,841 tons were from Mexican ores and 9,615 tons from Canadian ores, leaving a balance, drawn from Mexican and Canadian base bullion chiefly, of about 92,438 short tons, making allowance for waste in smelting.

WAREHOUSE TRANSACTIONS.

The following table shows the warehouse transactions of lead in ore and in base bullion monthly during 1901 and the corresponding totals for the years 1900, 1899, 1898, and 1897.

Imports of lead in ore and base bullion during the calendar year 1901, showing warehouse transactions by months.

Months.	Remaining in warehouse first day of each month.	Entered warehouse.		Additions by liquidation.
		Of direct importation.	From other districts.	
	Pounds.	*Pounds.*	*Pounds.*	*Pounds.*
January	42,379,270	34,618,817	18,889,031	100,774
February	35,266,965	17,587,756	15,450,188	11,556
March	36,726,477	21,168,250	20,275,478	82,831
April	30,256,252	18,341,514	19,951,767	32,852
May	31,002,220	20,504,453	19,417,098	....
June	31,764,895	12,191,289	18,958,530	37,210
July	30,309,496	16,918,092	13,556,740	56,262
August	24,563,394	18,298,109	20,992,061	7,118
September	30,960,181	10,570,696	11,519,265	51,415
October	27,971,643	16,201,056	23,580,559	11,170
November	38,139,565	21,579,722	14,832,366	15,696
December	37,900,026	13,051,025	7,279,087	186,113
January (1902)	33,225,677	....	....	....
Total	....	221,030,779	204,702,170	592,997
Total, 1900	....	226,644,190	249,674,008	1,576,397
Total, 1899	....	188,512,454	216,031,498	1,156,632
Total, 1898	....	170,017,006	177,837,309	1,326,934
Total, 1897	....	163,365,627	167,963,673	305,862

Months.	Withdrawn from warehouse.			Deductions by liquidation.
	For exportation.	For transportation.	For consumption.	
	Pounds.	*Pounds.*	*Pounds.*	*Pounds.*
January	22,093,450	31,932,935	2,302,822	4,391,720
February	15,048,705	14,239,025	1,949,274	352,984
March	18,223,782	22,047,176	1,456,093	6,269,733
April	18,204,148	18,172,028	845,114	358,875
May	17,046,094	20,068,023	1,433,311	611,448
June	16,669,876	13,210,924	1,693,987	1,067,641
July	18,335,471	17,055,761	621,356	264,608
August	13,533,004	17,992,005	865,922	509,570
September	16,008,315	8,561,322	353,686	206,591
October	15,218,335	13,455,847	131,259	819,422
November	10,514,230	19,604,971	1,019,863	5,528,259
December	13,304,009	5,530,630	3,363,242	2,992,693
January (1902)	....	....	....	....
Total	194,199,419	201,870,647	16,035,929	23,373,544
Total, 1900	195,917,622	217,565,289	15,829,631	28,842,770
Total, 1899	151,202,762	204,545,816	14,403,027	27,591,976
Total, 1898	147,978,938	163,405,296	7,844,184	28,650,385
Total, 1897	109,847,156	183,006,461	23,929,569	7,769,593

PRICES.

In previous volumes of the Mineral Resources the highest and the lowest prices of lead at New York were given for each month since 1870, the figures being compiled from market quotations. The following table shows the fluctuations since 1890:

Highest and lowest prices of lead at New York City, monthly, from 1890 to 1901, inclusive.

[Cents per pound.]

Year.	January.		February.		March.		April.	
	Highest.	Lowest.	Highest.	Lowest.	Highest.	Lowest.	Highest.	Lowest.
1890	3.85	3.80	3.85	3.75	3.95	3.85	4.07½	3.85
1891	4.50	4.05	4.50	4.25	4.37½	4.25	4.32½	4.10
1892	4.30	4.10	4.25	4.05	4.22½	4.10	4.30	4.20
1893	3.90	3.85	3.95	3.90	4.05	3.85	4.12½	4.05
1894	3.25	3.15	3.35	3.20	3.45	3.25	3.45	3.37½
1895	3.12½	3.05	3.12½	3.07½	3.10	3.07½	3.12½	3.05
1896	3.15	3	3.20	3.07½	3.22½	3.07½	3.07½	3.02½
1897	3.12½	3.02½	3.37½	3.12½	3.40	3.35	3.40	3.25
1898	3.70	3.55	3.80	3.55	3.70	3.60	3.62½	3.55
1899	4.25	3.90	4.50	4.25	4.45	4.30	4.35	4.27½
1900	4.75	4.70	4.75	4.70	4.75	4.70	4.75	4.65
1901	4.37½	4.37½	4.37½	4.37½	4.37½	4.37½	4.37½	4.37½

Year.	May.		June.		July.		August.	
	Highest.	Lowest.	Highest.	Lowest.	Highest.	Lowest.	Highest.	Lowest.
1890	4.35	4	4.50	4.25	4.50	4.40	4.72½	4.35
1891	4.37½	4.20	4.50	4.35	4.45	4.30	4.53	4.40
1892	4.25	4.20	4.20	4.05	4.25	4	4.15	4
1893	4	3.75	3.90	3.45	3.60	3.30	3.75	3.25
1894	3.40	3.30	3.37½	3.25	3.65	3.37½	3.70	3.30
1895	3.25	3.07½	3.30	3.25	3.50	3.30	3.55	3.50
1896	3.05	3	3.05	3	3	2.90	2.90	2.65
1897	3.37½	3.22½	3.60	3.25	3.90	3.65	4.10	3.70
1898	3.80	3.60	3.90	3.75	4	3.80	4.10	3.90
1899	4.50	4.37½	4.50	4.45	4.60	4.50	4.60	4.50
1900	4.70	4	4.25	3.75	4.25	4	4.37½	4.25
1901	4.37½	4.37½	4.37½	4.37½	4.37½	4.37½	4.37½	4.37½

Year.	September.		October.		November.		December.	
	Highest.	Lowest.	Highest.	Lowest.	Highest.	Lowest.	Highest.	Lowest.
1890	5	4.67½	5.25	5	5.25	4.60	4.60	4.05
1891	4.55	4.40	4.55	4.10	4.35	4.10	4.25	4.25
1892	4.15	4	3.95	3.85	3.85	3.70	3.85	3.70
1893	3.95	3.75	3.75	3.25	3.37½	3.30	3.30	3.20
1894	3.30	3.10	3.15	3.05	3.12½	3.10	3.12½	3.02½
1895	3.45	3.32½	3.35	3.30	3.27½	3.15	3.30	3.20
1896	2.80	2.72½	2.92½	2.72½	3.05	2.85	3.05	2.95
1897	4.35	4.25	4.25	3.85	3.85	3.75	3.75	3.65
1898	4.05	3.90	3.90	3.60	3.70	3.65	3.80	3.60
1899	4.60	4.55	4.60	4.57½	4.60	4.57½	4.75	4.57½
1900	4.37½	4.35	4.37½	4.35	4.37½	4.35	4.37½	4.35
1901	4.37½	4.37½	4.37½	4.37½	4.37½	4.37½	4.37½	4

This table shows that during the first eleven months of the year the price of lead was maintained at 4.37½ cents at New York. It was in December that the American Smelting and Refining Company reduced the official figure to 4 cents. The market in St. Louis, one of the principal distributing points of the country, however, represented in its prices more accurately the fluctuations in values. The following table exhibits the highest and lowest prices for soft lead produced in southeast Missouri and in the Galena-Joplin district:

Highest and lowest prices of lead at St. Louis in 1901.

[Cents per pound.]

Month.	Highest.	Lowest.
January	4.20	4.17½
February	4.22½	4.17½
March	4.22½	4.20
April	4.22½	4.20
May	4.20	4.17½
June	4.30	4.20
July	4.37½	4.27½
August	4.27½	4.25
September	4.25	4.20
October	4.25	4.20
November	4.25	4.20
December	4.20	3.80

THE LEAD MARKET.

During the whole of the year the lead market was held stationary by main force, although the quantities which consumption would not absorb were added to the stock in first hands. The principal interest had made contracts with the leading lead mines in the Rocky Mountain region under which the price paid for ore was on a basis of 4 cents per unit. Finally, toward the close of the year, the burden becoming troublesome, the base price was reduced to 3.50 cents per pound for lead in ore, and an arrangement was arrived at under which a restriction of output was possible.

The market was rather quiet early in the year, and was only moderately enlivened by the spring demand in the early months. The summer brought slightly higher values, but with the approach of fall indifference grew and the market weakened until the sharp break occurred in December.

A depressing effect upon values in this country was produced throughout the whole year by the low prices in Europe, which fell until toward the close of the year they reached £11 2s. 6d. in the London market, which is equivalent to 2.40 cents per pound here.

ZINC.

By Charles Kirchhoff.

PRODUCTION.

The maximum production in the history of zinc in the United States was reached in 1901, with an output of 140,822 short tons.

For a series of years the production of spelter has been as follows:

Production of spelter in the United States.

Year.	Quantity.	Year.	Quantity.
	Short tons.		*Short tons.*
1873	7,343	1891	80,873
1875	15,833	1892	87,260
1880	23,239	1893	78,832
1882	33,765	1894	75,328
1883	36,872	1895	89,686
1884	38,544	1896	81,499
1885	40,688	1897	99,980
1886	42,641	1898	115,399
1887	50,340	1899	129,051
1888	55,903	1900	123,886
1889	58,860	1901	140,822
1890	63,683		

In the different States the production has been as follows:

Production of spelter in the United States, by States.

Year.	Eastern and Southern States.	Illinois.	Kansas.	Missouri.	Total.
	Short tons.	*Short tons.*	*Short tons.*	*Short tons.*	*Short tons.*
1882	5,698	18,201	7,366	2,500	33,765
1883	5,340	16,792	9,010	5,730	36,872
1884	7,861	17,594	7,859	5,230	38,544
1885	8,082	19,427	8,502	4,677	40,688
1886	6,762	21,077	8,932	5,870	42,641
1887	7,446	22,279	11,955	8,660	50,340
1888	9,561	22,445	10,432	13,465	55,903
1889	10,265	23,860	13,658	11,077	58,860
1890	9,114	26,243	15,199	13,127	63,683
1891	[a] 8,945 [b] 4,217	28,711	22,747	16,253	80,873

[a] Eastern.

[b] Southern.

Production of spelter in the United States, by States—Continued.

Year.	Eastern and Southern States.	Illinois.	Kansas.	Missouri.	Total.
	Short tons.	*Short tons.*	*Short tons.*	*Short tons.*	*Short tons.*
1892	[a]9,582 [b]4,913	[c]31,383	24,715	16,667	87,260
1893	[a]8,802 [b]3,882	[c]29,596	22,815	13,737	78,832
1894	[a]7,400 [b]1,376	[c]28,972	25,588	11,992	75,328
1895	[a]9,484 [b]3,697	[c]35,732	25,775	14,998	89,686
1896	[a]8,139 [b]2,427	[c]36,173	20,759	14,001	81,499
1897	[a]7,218 [b]3,365	[c]37,876	33,396	18,125	99,980
1898	8,631	[c]47,103	40,132	19,533	115,399
1899	8,805	[c]50,118	52,021	18,107	129,051
1900	8,259	38,750	62,136	14,741	123,886
1901	8,603	[c]44,896	74,240	13,083	140,822

[a] Eastern. [b] Southern. [c] Including Indiana.

Illinois somewhat recovered its normal product during 1901. One of the smelters in the State, that of the Collinsville Zinc Company, in the St. Louis district, was closed down in August, the plan being to erect works in the Kansas gas belt during the current year. The Illinois Zinc Company, at Peru, Illinois, slightly increased its capacity by remodeling one of the furnaces. The Sandoval works will increase to a capacity of 2,400 tons per annum. The greatest development has taken place in the Kansas gas belt, so that the record of 1901 promises to be eclipsed in 1902. An entirely new plant was started in November, 1901, by Mr. A. B. Cockerill, consisting of 3 blocks, with 1,800 retorts, whose capacity is rated at 8,500 tons per annum. In March, 1902, the Standard Acid Company, now a part of the United Zinc and Chemical Company, began operations at a plant at Iola, whose capacity is rated at 50,000 pounds daily. The Prime Western Spelter Company, at Iola, was extended 50 per cent in 1901. At the same locality the Lanyon Zinc Company added two blocks of 630 retorts, increasing the output 15 tons per day; and Mr. George E. Nicholson, also at Iola, added to his works so as to increase the output about 68 per cent. A number of the old coal plants were entirely idle, among them being the Empire, at Joplin; Messrs. S. H. Lanyon & Brother, at Pittsburg, Kans.; the Girard Smelting Company, at Girard, Kans.; and the Ingalls Zinc Company. In Missouri, the Rich Hill works, at Rich Hill, were increased in capacity by 50 per cent. The old Humphrey Spelter Company was reorganized as the Vulcan Spelter Company, at Upland, Ind., but ran only six months in 1901, and has since been idle.

In 1902 interests indentified with the New Jersey Zinc Company purchased the works of the Prime Western Spelter Company and the new plant of Mr. A. B. Cockerill, both at Gas, Kans., and the two plants of Mr. George E. Nicholson, at Iola, Kans., and Nevada, Mo.

The American Smelting and Refining Company is building a spelter works in Colorado which will be completed this year.

An ambitious project was launched toward the close of 1901 to consolidate a number of zinc smelting works by a company entitled the Zinc Smelting Corporation, with a capital of $50,000,000, divided into $25,000,000 of 7 per cent cumulative preferred and $25,000,000 of common stock. The plants included were those of Mr. George E. Nicholson at Nevada, Mo., and Iola, Kans.; the Prime Western Spelter Company at Gas, Kans.; the Collinsville Zinc Company at Collinsville, Ill.; Mr. James La Tourette at Marion, Ind.; the Vulcan Spelter Company at Upland, Ind.; the Kansas Zinc Mining Company at Girard, Kans.; Mr. A. B. Cockerill, Gas, Kans.; the Bruce Mining and Smelting Company at Bruce, Kans.; the Cherokee-Lanyon Company at Weir, Kans., at Pittsburg, Kans., at Nevada, Mo., at Cherokee, Kans., and at Gas, Kans.; and the Lanyon Zinc Company at Iola, Kans., at La Harpe, Kans., and at Pittsburg, Kans.; the Empire Zinc Company, Joplin, Mo.; the Illinois Zinc Company, Peru, Ill.; and Messrs. Matthiessen & Hegeler, La Salle, Ill. It was estimated that the annual earnings of these corporations would be $2,856,002, the total rated capacity being 140,000 tons. The valuations were placed at $17,500,000, including mineral lands, gas and oil wells, coal lands, dwelling houses, sulphuric acid works, and steel mills. The project apparently never went beyond the state of soliciting underwriting.

CONSUMPTION.

During 1901 the home consumption of spelter was very large. The following estimate may be presented, coupled with the statement that the reports of the stocks from the producers are only partial, and that the stocks are therefore, in reality considerably larger. In a degree, however, the figures reflect the fluctuations in the stocks, and thus possess some value as indicating the relative position from year to year:

Estimated consumption of spelter from 1895 to 1901, inclusive.

Source, etc.	1895.	1896.	1897.	1898.	1899.	1900.	1901.
	Short tons.	*Short tons.*	*Short tons.*	*Short tons.*	*Short tons.*	*Short tons.*	*Short tons.*
Production	89,686	81,499	99,980	115,399	129,051	123,886	140,822
Imports	432	428	1,279	1,303	1,392	961	357
Stocks at beginning of year	4,911	5,802	7,477	5,709	3,695	2,798	5,813
Total snpply	95,029	87,729	108,736	122,411	134,138	127,645	146,992
Deduct—							
Exports of foreign	....	4	....	18	....	23	....
Exports of domestic	1,530	10,130	14,245	10,499	6,755	22,410	3,390
Stock at end of year	5,802	7,477	5,709	3,695	2,798	5,813	1,905
Total	7,332	17,611	19,954	14,212	9,553	28,246	5,295
Apparent home consumption	87,697	70,118	88,782	108,199	124,585	99,399	141,697

These figures show an exceptionally heavy consumption of spelter, which is in line with the very large consumption in other branches of the metal trade, and particularly in the galvanizing industry.

ZINC MINING IN THE GALENA-JOPLIN DISTRICT.

The year 1901 was one of fair prosperity for the zinc-mining industry of southwest Missouri and southeast Kansas, which district maintains its position of overshadowing importance.

The following statistics of the production of the district were compiled by Mr. Jesse A. Zook, of Joplin, for the Daily News Herald:

Production of zinc and lead ore in the Galena-Joplin district in 1901.

Camp.	Zinc ore.			Lead ore.		Total value.
	Quantity, 1900.	Quantity, 1901.	Value.	Quantity, 1901.	Value.	
	Short tons.	*Short tons.*		*Short tons.*		
Galena, Kans	45,043	33,930	$817,069	5,270	$242,941	$1,060,010
Joplin, Mo	54,876	67,232	1,795,573	12,227	566,157	2,361,730
Carterville	39,146	44,348	1,061,286	8,772	406,664	1,467,950
Aurora	22,197	20,435	426,579	566	28,173	454,752
Oronogo	18,473	16,480	408,030	877	39,193	447,223
Webb City	12,643	13,741	324,237	840	38,525	362,762
Zincite	9,386	9,452	252,599	176	7,915	260,514
Granby	7,838	7,941	137,456	1,075	47,360	184,816
Duenweg	5,147	4,235	102,855	1,479	67,886	170,741
Neck City and Alba	4,086	7,633	203,286	26	1,187	204,473
Central City	3,955	3,470	83,379	292	13,823	97,202
Stotts City	3,716	1,124	30,226	46	2,138	32,364
Cave Springs	3,882	3,804	97,229	364	16,863	114,092
Roaring Springs	3,578	3,614	78,469	189	8,650	87,119
Carthage	3,287	4,283	113,488	10	471	113,959
Carl Junction	2,883	6,723	185,817	177	7,990	193,807
Spring City	....	4,512	103,858	1,883	86,327	190,185
Miscellaneous	4,493	3,963	96,813	639	28,718	125,531
Total, 1901	....	256,920	6,318,249	34,908	1,610,981	7,929,230
Total, 1900	....	244,629	6,583,944	29,176	1,402,678	7,986,622
Total, 1899	....	255,088	....	28,888	....	10,715,307

It will be observed that in spite of an increased production of both zinc ore and lead ore, the gross value is somewhat less than it was in 1900.

For previous years the production of the district has been as follows, according to the Joplin Mining News:

Production of zinc and lead ore in the Joplin-Galena district.

Year.	Zinc ore.	Lead ore.	Total value both ores.
	Short tons.	*Short tons.*	
1894	147,310	32,199	$3,535,736
1895	144,487	31,294	3,775,929
1896	155,333	27,721	3,857,355
1897	177,976	30,105	4,726,302
1898	234,455	26,687	7,119,867
1899	255,088	23,888	10,715,307
1900	244,629	29,176	7,986,622
1901	256,920	34,938	7,929,230

The average base prices, from month to month during 1901, for ores in the district have been as follows:

Average base prices of zinc and lead ores in 1901.

Month.	Zinc, per short ton.	Lead, per 1,000 pounds.	Month.	Zinc, per short ton.	Lead, per 1,000 pounds.
January	$23.73	$22.80	November	$26.15	$23.14
February	23.96	22.50	December	28.24	22.35
March	23.70	23.10			
April	24.58	22.76	Average realized price:		
May	24.38	23.49	1901	24.21	22.99
June	24.22	23.52	1900	26.50	24.16
July	24.38	23.49	1899	38.50	27.23
August	23.88	22.90	1898	28.44	....
September	22.82	23.16	1897	22.28	....
October	24.63	23.15	1896	22.33	....

A new source of zinc ore supply is Crittenden County, Ky. The Kentucky Fluorspar Company shipped between June 1, 1901, and January 1, 1902, 1,136 short tons of carbonate from Marion, Ky., to Mineral Point, Wis., and the average value of the ore was $13.60 per ton, f. o. b. Marion.

IMPORTS AND EXPORTS.

The depression in the leading European industrial countries in 1901, and the heavy consumption in our own, led to a decided falling off in the export movement in spelter. The exports of zinc ore, however, continued at the former rate.

For a series of years the imports and exports have been as follows:

Zinc imported and entered for consumption in the United States, 1867 to 1901, inclusive.

Year ending—	Block or pigs.		Sheets.	
	Quantity.	Value.	Quantity.	Value.
June 30—	*Pounds.*		*Pounds.*	
1867	5,752,611	$256,366	5,142,417	$311,767
1868	9,327,968	417,273	3,557,448	203,883
1869	13,211,575	590,332	8,306,723	478,646
1870	9,221,121	415,497	9,542,687	509,860
1871	11,159,040	508,355	7,646,821	409,243
1872	11,802,247	522,524	10,704,944	593,885
1873	6,839,897	331,399	11,122,143	715,706
1874	3,593,570	203,479	6,016,835	424,504
1875	2,034,252	101,766	7,320,713	444,539
1876	947,322	56,082	4,611,360	298,308
1877	1,266,894	63,250	1,341,333	81,815
1878	1,270,184	57,753	1,255,620	69,381
1879	1,419,791	53,294	1,111,225	53,050
1880	8,092,620	371,920	4,069,310	210,230
1881	2,859,216	125,457	2,727,324	129,158
1882	18,408,391	736,964	4,413,042	207,032
1883	17,067,211	655,503	3,309,239	141,823
1884	5,869,738	208,852	952,253	36,120
1885	3,515,840	113,268	1,839,860	64,781
December 31—				
1886	4,300,830	136,138	1,092,400	40,320
1887	8,387,647	276,122	926,150	32,526
1888	3,825,947	146,156	295,287	12,558
1889	2,052,559	77,845	1,014,873	43,356
1890	1,997,524	101,335	781,366	43,495
1891	808,094	41,199	21,948	1,460
1892	297,969	16,520	27,272	2,216
1893	425,183	22,790	28,913	1,985
1894	387,788	13,788	39,947	2,061
1895	744,301	26,782	42,513	2,773
1896	1,040,719	32,096	27,321	1,358
1897	2,905,451	109,520	15,971	786
1898	2,605,028	104,669	39,712	2,724
1899	2,783,329	143,557	86,878	6,354
1900	1,767,756	86,653	155,144	10,801
1901	556,434	22,766	157,787	10,467

Zinc imported and entered for consumption in the United States, 1867 to 1901—Cont'd.

Year ending—	Old.		Value of manufactures.	Total value.
	Quantity.	Value.		
June 30—	*Pounds.*			
1867	....	....	$1,835	$569,968
1868	....	....	1,623	622,779
1869	....	....	2,083	1,071,061
1870	....	....	21,696	947,053
1871	....	....	26,366	943,964
1872	....	....	58,668	1,175,077
1873	....	....	56,813	1,103,918
1874	....	....	48,304	676,287
1875	....	....	26,330	572,635
1876	....	....	18,427	372,817
1877	....	....	2,496	147,561
1878	....	....	4,892	132,026
1879	....	....	3,374	109,718
1880	....	....	3,571	585,721
1881	....	....	7,603	262,218
1882	....	....	4,940	948,936
1883	....	....	5,606	802,932
1884	....	....	4,795	249,767
1885	....	....	2,054	180,103
December 31—				
1886	....	....	9,162	185,620
1887	....	....	11,329	319,977
1888	....	....	12,080	170,794
1889	....	....	19,580	140,781
1890	....	....	9,740	154,570
1891	....	....	....	42,659
1892	115,203	$6,556	20,677	45,969
1893	265	21	16,479	41,275
1894	27,754	530	11,816	28,195
1895	64,398	899	9,953	40,407
1896	14,855	267	9,800	43,521
1897	41,643	886	11,459	122,651
1898	96,899	3,417	11,211	122,021
1899	167,954	6,932	8,824	165,667
1900	155,670	6,379	24,257	128,090
1901	150,168	3,277	39,549	76,059

Imports of zinc oxide from 1885 to 1901.

Year ending—	Dry.	In oil.	Year ending—	Dry.	In oil.
	Pounds.	*Pounds.*	December 31—	*Pounds.*	*Pounds.*
June 30, 1885	2,233,128	98,566	1893	3,900,749	254,807
December 31—			1894	3,371,292	59,291
1886	3,526,289	79,788	1895	4,546,049	129,343
1887	4,961,080	123,216	1896	4,572,781	311,023
1888	1,401,342	51,985	1897	5,564,763	502,357
1889	2,686,861	66,240	1898	3,342,235	27,050
1890	2,631,458	102,298	1899	3,012,709	41,699
1891	2,839,351	128,140	1900	2,618,808	38,706
1892	2,442,014	111,190	1901	3,199,778	128,198

Since 1864 the exports have been as follows:

Exports of zinc and zinc ore of domestic production from 1864 to 1901.

Year ending—	Ore or oxide.		Plates, sheets, pigs, or bars.		Value of manufactures.	Total value.
	Quantity.	Value.	Quantity.	Value.		
June 30—	*Cwt.*		*Pounds.*			
1864	14,810	$116,431	95,738	$12,269	....	$128,700
1865	99,371	114,149	184,183	22,740	....	136,889
1866	4,485	25,091	140,798	13,290	....	38,381
1867	3,676	32,041	312,227	30,587	....	62,628
1868	8,344	74,706	1,022,699	68,214	....	142,920
1869	....	65,411	....	....	....	65,411
1870	15,286	81,487	110,157	10,672	....	92,159
1871	9,621	48,292	76,380	7,823	....	56,115
1872	3,686	20,880	62,919	5,726	....	26,606
1873	234	2,304	73,953	4,656	....	6,960
1874	2,550	20,037	43,566	3,612	....	23,649
1875	3,083	20,659	38,090	4,245	$1,000	25,904
1876	10,178	66,259	134,542	11,651	4,333	82,243
1877	6,428	34,468	1,419,922	115,122	1,118	150,708
1878	16,050	83,831	2,545,320	216,580	567	300,978
1879	10,660	40,399	2,132,949	170,654	....	211,053
1880	13,024	42,036	1,368,302	119,264	....	161,300
1881	11,390	16,405	1,491,786	132,805	168	149,378
1882	10,904	13,736	1,489,552	124,638	....	138,374
1883	3,045	11,509	852,333	70,981	734	83,224
1884	4,780	16,685	126,043	9,576	4,666	30,927
1885	6,840	22,824	101,685	7,270	4,991	35,085
December 31—						
1886	26,620	49,455	917,229	75,192	13,526	138,173
1887	4,700	17,286	136,670	9,017	16,789	43,092
1888	4,560	18,034	62,234	4,270	19,098	41,402
1889	26,760	73,802	879,785	44,049	35,732	153,583
1890	77,360	195,113	3,295,584	126,291	23,587	344,991
1891	115,820	149,435	4,294,656	278,182	38,921	466,538
1892	18,380	41,186	12,494,335	669,549	166,794	877,529
1893	980	1,271	7,446,934	413,673	224,787	639,731
1894	....	5	3,607,050	144,074	99,406	243,485
1895	480	1,008	3,060,805	153,175	50,051	204,234
1896	41,500	47,408	20,260,169	1,013,620	51,001	1,112,029
1897	165,200	211,350	28,490,662	1,356,538	71,021	1,638,909
1898	210,400	299,870	20,998,413	1,033,959	138,165	1,471,994
1899	503,940	725,944	13,509,316	742,521	143,232	1,611,697
1900	751,100	1,133,663	44,802,577	2,217,693	99,288	3,450,644
1901	788,500	1,167,684	6,780,221	288,906	82,046	1,538,636

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An analysis of the exports of metal and of ore during the years 1899, 1900, and 1901 by ports of shipment and by countries of destination is of interest.

Exports of zinc ore by customs districts during 1899, 1900, and 1901.

Customs district.	1899.		1900.		1901.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Long tons.		*Long tons.*		*Long tons.*	
New York	14,075	$400,159	15,187	$445,622	24,092	$694,995
Philadelphia	3,760	109,750	10,209	300,850	2,039	62,145
Galveston	5,847	197,840	2,273	70,844	291	8,512
New Orleans	439	15,365	9,150	294,684	13,003	402,032
Newport News	22	550				
Puget Sound	54	2,280				
Detroit			349	10,300		
Huron			364	10,713		
All other districts			23	650		
Total	24,197	725,944	37,555	1,133,663	39,425	1,167,684

The ore shipped from New York and Philadelphia is from the famous New Jersey mines. That sent from the Gulf ports is from the Joplin-Galena district and from Colorado.

The following table shows the destination of the ore exports:

Exports of zinc ore by countries during 1899, 1900, and 1901.

Country.	1899.		1900.		1901.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Long tons.		*Long tons.*		*Long tons.*	
Belgium	5,636	$189,672	11,280	$361,323	13,167	$406,734
Netherlands	18,047	516,724	25,375	745,750	26,137	757,295
Germany	10	339			1	40
United Kingdom	450	16,929	161	4,830	120	3,615
Canada	54	2,280	736	21,663		
Mexico			3	97		
Total	24,197	725,944	37,555	1,133,663	39,425	1,167,684

It will be observed that the New Jersey ore goes to the Netherlands and that the Western ore is forwarded direct to Belgian ports.

The exports of spelter by customs districts and by countries of destination are exhibited in the following tables:

Exports of zinc by customs districts during 1899, 1900, and 1901.

Customs district.	1899.		1900.		1901.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Pounds.		*Pounds.*		*Pounds.*	
New York	939,462	$61,438	1,897,004	$109,910	3,827,740	$159,832
Philadelphia	....	....	5,017	315	....	....
Norfolk and Newport News	....	....	768,213	45,593	710,200	30,631
Baltimore	....	....	2,354,186	121,113	....	....
Galveston	5,466,725	318,192	19,761,628	1,011,694	....	....
New Orleans	6,624,532	336,591	17,918,915	834,457	1,171,068	53,074
Detroit	302,390	16,176	317,972	16,945	....	....
Huron	148,375	8,280	416,447	19,114	936,227	38,507
All other districts	27,832	1,844	1,363,195	58,552	134,986	6,862
Total	13,509,316	742,521	44,802,577	2,217,693	6,780,221	288,906

A very important part of the spelter exports from Atlantic ports is the high-grade spelter of New Jersey, Pennsylvania, and Virginia. The Western spelter is exported from Gulf ports.

The destination of the exports of zinc is shown in the following table:

Exports of zinc, by countries, during the calendar years 1899, 1900, and 1901.

Country.	1899.		1900.		1901.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Pounds.		*Pounds.*		*Pounds.*	
Belgium	226,500	$11,325	4,195,509	$189,838	83,545	$3,770
France	932,166	46,858	5,712,129	279,215	....	....
Germany	12,249	702	65,669	3,543	1,000	50
Netherlands	12,560	806	615,003	31,723	....	....
Russia, Baltic and White Seas	224,000	13,440	....	....	....	....
United Kingdom	11,541,072	636,636	33,378,240	1,669,950	5,167,274	218,841
Canada	458,140	24,978	746,744	36,824	1,035,020	43,753
All other countries	102,629	7,776	89,283	6,600	493,382	22,492
Total	13,509,316	742,521	44,802,577	2,217,693	6,780,221	288,906

It will be observed that the only increase in the exports in 1901 took place to Canada, and that Continental Europe received very small quantities.

PRICES.

The spelter market opened dull in 1901, with a tendency toward weakness, while the agitation in favor of concerted action to export ore did not prevent developing into a sharp decline toward the end of January. With the exception of a brief show of strength in the middle of February, the market continued weak until the end of March. European advices continued unfavorable, the price declining finally to £16 in the London market, which is equivalent to 3.50 cents, so that exports were out of the question. April brought a larger business, with advancing prices, until 4 cents per pound was reached in the New York market. May was a quiet month, and values receded somewhat. June brought some temporary moderate activity, but the market again relapsed into dullness, which continued through July and the early part of August, the market becoming a shade firmer during the end of the month. September finally brought the settlement of the steel strike, which had adversely affected the spelter market, because it cut off a considerable part of the large consumption on the part of makers of galvanized sheets. Reports of efforts to patch up the European syndicate and rumors of consolidation plans in this country contributed their share to active buying, and heavy transactions characterized the second half of September and the early part of October. Under the stimulus of this business prices moved upward, until 4.25 cents was reached. In October it became known that the attempt to bring the European smelters together had failed. The market entered November quiet but firm, and the announcement of the proposed consolidation of many of the leading Western zinc concerns contributed to creating a good deal of activity and somewhat higher prices. Consumers covered quite generally for the first quarter of 1902, but after that demand had been satisfied the market again became quiet and remained so.

The following table summarizes the prices of spelter since 1875:

Prices of common Western spelter in New York City, 1875 to 1895, inclusive.

[Cents per pound.]

Year.	Highest.	Lowest.
1875	7.35	6.20
1876	8	6.37
1877	6.50	5.50
1878	5.75	4.25
1879	6.25	4.12
1880	6.75	4.62
1881	6	4.75
1882	6	4.50
1883	4.75	4.30
1884	4.65	4
1885	4.62	4
1886	4.60	4.25
1887	5.87	4.40
1888	5.37	4.50
1889	5.35	4.62
1890	6.10	4.20
1891	6	4.65
1892	4.90	4.35
1893	4.50	3.55
1894	4	3.25
1895	4.35	3.10

Price of common Western spelter in New York City, 1896 to 1901, inclusive.

[Cents per pound.]

Year.	January.		February.		March.		April.	
	Highest.	Lowest.	Highest.	Lowest.	Highest.	Lowest.	Highest.	Lowest.
1896	4.05	4	4.15	4	4.15	4.10	4.20	4.05
1897	4.10	3.90	4.10	4	4.15	4.10	4.15	4.10
1898	4	3.90	4.10	3.90	4.25	4.15	4.30	4.15
1899	5.70	5.15	6.50	5.70	6.50	6.25	6.80	6.20
1900	4.75	4.50	4.75	4.55	4.70	4.50	4.75	4.55
1901	4.15	4.02	4.02	3.92	3.95	3.87	4.05	3.92

Year.	May.		June.		July.		August.	
	Highest.	Lowest.	Highest.	Lowest.	Highest.	Lowest.	Highest.	Lowest.
1896	4.15	4	4.15	4	4.10	3.90	3.90	3.65
1897	4.20	4.10	4.25	4.15	4.30	4.20	4.35	4.25
1898	4.30	4.10	5.15	4.30	4.80	4.45	4.75	4.45
1899	7	6.75	6.75	6.15	6.25	6	6	5.30
1900	4.55	4.50	4.40	4.15	4.25	4.15	4.15	4.10
1901	4.02	3.92	4	3.95	3.92	3.90	4	3.92

Year.	September.		October.		November.		December.	
	Highest.	Lowest.	Highest.	Lowest.	Highest.	Lowest.	Highest.	Lowest.
1896	3.70	3.60	3.75	3.65	4.25	3.75	4.25	4.15
1897	4.35	4.25	4.30	4.15	4.25	3.90	3.90	3.75
1898	4.82½	4.70	5.15	4.82½	5.25	5.15	5.30	4.90
1899	5.75	5.20	5.50	5.15	5	4.50	4.70	4.55
1900	4.10	4.05	4.15	4.05	4.30	4.10	4.25	4.05
1901	4.10	4.00	4.35	4.07	4.37	4.30	4.50	4.30

ZINC WHITE.

The production of zinc white from ores amounted to 46,500 short tons. A new manufactory was started at West Plains, Mo., on December 20, by the Renfrew Zinc Oxide Company. The plant of the Ozark Zinc Oxide Company at Joplin, Mo., was not completed in 1901. Each of these plants has an estimated capacity of about 2,000 tons of oxide per annum.

THE WORLD'S PRODUCTION.

Messrs. Henry R. Merton & Co., Limited, of London, on the basis of detailed reports, make the production of spelter in Europe as follows:

Production of zinc in Europe from 1895 to 1901, inclusive.

[Long tons.]

Country or district.	1895.	1896.	1897.	1898.	1899.	1900.	1901.
Rhine, Belgium, and Holland	172,135	179,730	184,455	188,815	189,955	186,320	199,285
Silesia	94,015	95,875	94,045	97,670	98,590	100,705	106,385
Great Britain	29,495	24,880	23,550	27,940	31,715	29,830	29,190
Austria and Italy	8,355	9,255	8,185	7,115	7,190	6,975	7,700
France and Spain	22,895	28,450	32,120	32,135	32,955	30,620	27,265
Poland	4,960	6,165	5,760	5,575	6,225	5,875	5,935
Total	331,855	344,355	348,115	359,250	366,630	360,325	375,760
United States	80,076	72,767	89,268	103,061	115,224	110,612	125,734
Total world's production	411,931	417,122	437,383	462,311	481,854	470,937	501,494
United States percentage of world's production	19.4	17.4	20.4	22.3	23.9	23.5	25.1

The largest producer in the world is the Vieille Montague Company, which has a record of 72,330 long tons in 1901, as compared with 68,815 tons in 1900. The next three largest makers are in Silesia, being, in their order: Schlesische Aktien-Gesellschaft, 26,285 tons; G. von Giesche's Erben, 25,095 tons; and Hohenlohe, 24,325 tons. The Société Asturienne, with properties in France and Spain, follows with 21,200 tons; Stolberg, in the Rhine district, with 18,615 tons; Graf H. Henckel von Donnersmarck, in Silesia, with 17,150 tons; and G. Dumont & Freres, with 12,680 tons, and the Société Prayon, with 12,080 tons, bring up the rear of the concerns producing more than 10,000 tons annually. In the United States the Lanyon Zinc Company would take rank as the second largest in the world, and there would be included in the category of the makers exceeding 10,000 tons per annum, in the order named, the Edgar Zinc Company, Matthiessen & Hegeler, and the Illinois Zinc Company. With its recent acquisitions the New Jersey Zinc Company would be entitled to a place.

ALUMINUM AND BAUXITE.

By Joseph Struthers.

ALUMINUM.

PRODUCTION.

The production of aluminum in the United States during 1901 amounted to 7,150,000 pounds, which corresponds exactly with the production during 1900. A comparison of these figures with the production of 6,500,000 pounds in 1899 shows the continued development of this important industry. As in previous years, the Pittsburg Reduction Company, operating the Hall patents, was the sole producer of aluminum in this country; and although the demand has increased from the more extended use of the metal for the manufacture of special alloys and electrical conductors, the price of aluminum per pound has continued practically stationary throughout the year, as is detailed in the subjoined table:

Prices of aluminum in 1901.

	Small lots.	100-pound lots.	1,000-pound lots.	2,000-pound lots.
	Cents.	*Cents.*	*Cents.*	*Cents.*
No. 1; aluminum, 99.75 per cent	37	35	34	33
No. 2; aluminum, 90 per cent	34	33	32	31
Nickel-aluminum casting metal, 10 per cent nickel	39	35	34	33
Special casting alloy, 80 per cent aluminum	35	30	29	27

The following table shows the production of aluminum in the United States for each year since the inception of the industry in 1883:

Production of aluminum in the United States from 1883 to 1901, inclusive.

Year.	Quantity.
	Pounds.
1883	83
1884	150
1885	283
1886	3,000
1887	18,000
1888	19,000
1889	47,468
1890	61,281
1891	150,000
1892	259,885
1893	333,629
1894	550,000
1895	920,000
1896	1,300,000
1897	4,000,000
1898	5,200,000
1899	6,500,000
1900	7,150,000
1901	7,150,000
Total	33,662,779

IMPORTS.

In the first table below are given the quantities and values of the aluminum imported into the United States from 1870 to 1890, and in the second table are given the quantities and values of crude and manufactured aluminum imported from 1891 to 1901.

Aluminum imported and entered for consumption in the United States from 1870 to 1890.

Year ending—	Quantity.	Value.	Year ending—	Quantity.	Value.
June 30—	*Pounds.*		June 30—	*Pounds.*	
1870	....	$98	1881	517.10	$6,071
1871	....	341	1882	556.50	6,450
1872	....	....	1883	426.25	5,070
1873	2.00	2	1884	595.00	8,416
1874	683.00	2,125	1885	439.00	4,736
1875	434.00	1,355	Dec. 31—		
1876	139.00	1,412	1886	452.10	5,369
1877	131.00	1,551	1887	1,260.00	12,119
1878	251.00	2,978	1888	1,348.53	14,086
1879	284.44	3,423	1889	998.00	4,840
1880	340.75	4,042	1890	2,051.00	7,062

Imports of crude and manufactured aluminum from 1891 to 1901.

Calendar year.	Crude.		Leaf.		Plates, sheets, bars, and rods.		Manufactures.	Total value.
	Quantity.	Value.	Packs of 100.	Value.	Quantity.	Value.		
	Pounds.				*Pounds.*			
1891	3,922	$6,266	10,033	$1,135	....	....	$1,161	$8,562
1892	43	51	11,540	1,202	....	....	1,036	2,289
1893	7,816	4,683	18,700	1,903	....	....	1,679	8,265
1894	5,306	2,514	10,780	1,210	....	....	386	4,110
1895	25,294	7,814	6,610	646	....	....	1,841	10,301
1896	698	591	4,657	523	....	....	2,365	3,479
1897	1,822	1,082	4,260	368	4,421	$3,058	221	4,729
1898	60	30	2,000	174	18,442	8,991	4,675	13,870
1899	53,622	9,425	693	112	4,254	2,413	5,303	17,253
1900	256,559	44,455	1,103	102	4,264	2,776	3,111	50,444
1901	564,803	104,168	....	....	7,764	5,319	261	109,748

WORLD'S PRODUCTION.

The following table shows the world's production of aluminum in 1900:

World's production of aluminum in 1900.

Country.	Quantity.	Value.
	Metric tons.	
United States	3,244	$1,920,000
France	1,026	525,600
Great Britain	569	364,000
Switzerland	1,300	780,000
Total	6,139	3,589,600

BAUXITE.

PRODUCTION.

During the year 1901 the production of bauxite amounted to 18,905 long tons, valued at $79,914 at the mines, as compared with 23,184 tons during the preceding year. Georgia yielded the greater bulk of the production, the remainder being supplied by Alabama and Arkansas. At Bauxite, Ark., the Pittsburg Reduction Company is installing a very large mining plant, which will probably be in operation before the close of the present year, and promises to contribute largely to the output from Arkansas in 1903. The subjoined table gives the production and value of bauxite for each year since 1889:

Production of bauxite in the United States from 1889 to 1901, by States.

Calendar year.	Georgia.	Alabama.	Arkansas.	Total.	Value.
	Long tons.	*Long tons.*	*Long tons.*	*Long tons.*	
1889	728	....	....	728	$2,366
1890	1,844	....	....	1,844	6,012
1891	3,301	292	....	3,593	11,675
1892	5,110	5,408	....	10,518	34,183
1893	2,415	6,764	....	9,179	29,507
1894	2,050	9,016	....	11,066	35,818
1895	3,756	13,313	....	17,069	44,000
1896	7,313	11,051	....	18,364	47,338
1897	7,507	13,083	....	20,590	57,652
1898	....	....	....	25,149	75,437
1899	15,736	14,499	5,045	35,280	125,598
1900	19,739		3,445	23,184	89,676
1901	18,038		867	18,905	79,914

These figures of production and value have been compiled with the kind cooperation of Mr. William G. Neilson, president of the Republic Mining and Milling Company.

Bauxite is used mainly for the manufacture of aluminum, although a considerable quantity is used for the manufacture of aluminum sulphate and crystallized alum.

CONSUMPTION.

In order to show the annual consumption of bauxite and its value in the United States during the last five years, the following table has been compiled, which includes the total production, imports, exports, and consumption, with the value of each:

Production, imports, exports, and consumption of bauxite in the United States from 1897 to 1901.

Year.	Total production.		Imports.		Exports.		Consumption.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Long tons.		*Long tons.*		*Long tons.*		*Long tons.*	
1897	20,590	$57,652	2,645	$10,515	2,537	$5,074	20,698	$63,093
1898	25,149	75,437	1,201	4,238	1,000	2,000	25,350	77,675
1899	35,280	125,598	6,666	23,768	2,030	4,567	39,916	144,799
1900	23,184	89,676	8,656	32,967	1,000	3,000	30,840	119,643
1901	18,905	79,914	18,313	67,107	1,000	3,000	36,218	144,021

The increased importation of bauxite during 1901 (18,313 tons, as compared with 8,656 tons in 1900) was due mainly to the low ocean freight rates from foreign ports. Practically the entire amount of bauxite imported was derived from the south of France at an average ocean rate to New York, Philadelphia, or Baltimore of $2.25 per ton, which, with the duty on bauxite of $1 per ton, allowed the ore to be laid down at a cost of $3.25 per ton. This cost, contrasted with the freight rates from Georgia or Alabama of $3.85 per ton to Philadelphia and $5 or more per ton to Boston, shows that the French ore can be delivered to seaport cities more cheaply than the domestic ore. The high percentage of iron in the French bauxite precludes its use for the manufacture of aluminum sulphate. It is consumed mainly for making aluminum hydrate, which is used in the manufacture of metallic aluminum.

WORLD'S PRODUCTION.

The following table shows the world's production of bauxite in 1900:

World's production of bauxite in 1900.

Country.	Quantity.	Value.
	Metric tons.	
United States	23,563	$89,676
France	58,530	92,596
Great Britain	5,873	6,750
Total	87,966	189,022

ALUMINUM SALTS.

The principal salts of aluminum are aluminum sulphate and crystallized alum, for the manufacture of which bauxite and Greenland cryolite are consumed. The Pennsylvania Salt Company possesses the exclusive privilege of importing cryolite into North and South America. In 1901, the production of aluminum sulphate was 74,721 short tons, and that of crystallized alum was 7,755 tons. The companies producing one or both of these salts during 1901, in the order of output, are: The General Chemical Company, the Pennsylvania Salt Company, Harrison Brothers, Charles Lennig & Co., the Erie Chemical Company, the Cochrane Chemical Company, the Merrimac Chemical Company, and the Detroit Chemical Company.

PLATINUM.

By Joseph Struthers.

PRODUCTION.

The production of platinum from domestic ores in the United States during 1901 was 1,408 ounces, valued at $27,526, as compared with 400 ounces of crude platinum, valued at $2,500, in 1900, a notable increase, although the total quantity so produced was but a small part of the total domestic consumption for the year. The production during 1901 was the largest annual output on record since statistics of platinum produced from domestic ores were first compiled in 1880. The next largest output was in 1890, when 600 ounces, valued at $2,500, were produced. In connection with the production of platinum from domestic ores during 1901, there were obtained also 253 ounces of iridium, a metal so closely allied with platinum in its properties that doubtless it has formed from 15 to 25 per cent of the reported platinum production in early years.

The domestic supply of platinum in recent years has been obtained as a secondary product chiefly from gold placer deposits in Trinity and Shasta counties, Cal. The occurrence of the metal has been reported in many other gold placers of California, as well as in Washington, Oregon, Idaho, Montana, and Alaska; but the deposits have not been sufficiently rich to place the extraction of the metal on a profitable basis.

The mineral chromite is nearly always associated with platinum, and occurs in extensive serpentine formations of many mountain ranges in which streams have their head; and in most deposits containing platinum in place the metal occurs with chromite disseminated through basic magnesium rock, of which serpentine is a common alteration product.

It has been forecast as within the range of probability that platinum will be found in place associated with chromite in the basic magnesium rocks of California and Oregon as well as in peridotite, the basic magnesium rock of North Carolina, Georgia, Pennsylvania, and Maryland, which frequently contains chromite.

A new occurrence of sperrylite, the platinum arsenide mineral, has been reported from Macon County, N. C., where it occurs in minute quantities; but there has been no authentic record of the occurrence of metallic platinum in the Eastern or Southern States.

The most noteworthy feature of the platinum industry in the United States during 1901 was the discovery of the metal in the copper ores of the Rambler mine, near Encampment, in the Medicine Bow Mountains of Albany County, Wyo. In addition to platinum, other metals in the platinum group were present—osmium, palladium, and iridium. The metals are not distributed uniformly throughout the ore, some samples showing palladium and others platinum only, but in most cases all four were present. The platinum content of the ore varied from 0.06 to 1.4 ounces per ton, and in a sample of covellite the copper sulphide mineral, CuS, it was as high as 12 ounces. The platinum occurs in the form of sperrylite, and in all probability palladium also will be found as an analogous arsenic compound. As a result of this discovery, it is important to examine all copper ores for metals of the platinum group. So far the residues from the electrolytic process in a few of the largest copper refineries have failed to show the presence of the metal; yet it is to be hoped that future discoveries of platinum will be made which will tend to alleviate the present threatened dearth of this important metal. Chrome ore deposits, also, should be examined carefully for platinum, as this mineral is its most common associate. The discovery of a use for osmium, which occurs to a considerable extent in the American platinum as the mineral osmiridium, will greatly benefit the platinum industry of the United States, as in the past this element has interfered most seriously with the sale of the crude platinum product. The demand for osmium for the new Auer incandescent electric light makes it almost as desirable as platinum.

The imports of platinum during 1901 were valued at $1,695,895, as compared with $1,762,020 in 1900. The world's annual production of platinum for the last few years has ranged between 160,000 and 170,000 ounces, of which, as far as can be ascertained, Russia supplies at least 150,000 ounces, the remainder being obtained mainly from South America.

The following table gives the production of crude platinum in the United States from 1880 to 1900, and of refined metal from domestic ores during 1901, which shows the extremely small proportion of the domestic consumption supplied from domestic sources:

Production of crude platinum in the United States from 1880 to 1900, and of refined metal from domestic ores in 1901.

Year.	Quantity.	Value.[a]	Year.	Quantity.	Value.[a]
	Ounces.			*Ounces.*	
1880	100	$400	1891	100	$500
1881	100	400	1892	80	550
1882	200	600	1893	75	517
1883	200	600	1894	100	600
1884	150	450	1895	150	900
1885	250	187	1896	163	944
1886	50	100	1897	150	900
1887	448	1,838	1898	225	3,375
1888	500	2,000	1899	300	1,800
1889	500	2,000	1900	400	2,500
1890	600	2,500	1901	1,408	27,526

[a] The chief variations in price have been due to the quality of the crude grains. In 1901, however, the average price for the refined metal has been given.

During the last two years the price of platinum has steadily advanced from its lowest point, in 1895, of $10 an ounce to $21 an ounce, which was reached in the latter part of 1901. The demand is in excess of the supply, and it is believed that the price will continue to advance. The pure platinum content of platinum sands has ranged in value from $18 to $22 per ounce, and quotations per troy ounce in New York for the ingot metal remained at $18.20 from the beginning of the year until May 11, and thence until the close of September it ruled at $20.50; during October, November, and December the price ranged from $20 to $21 per ounce. Osmiridium is quoted at from $6 to $10 per ounce.

Dr. David T. Day has detected platinum in the auriferous sand at Corozal, Porto Rico. This is the only definite report of platinum in the West Indies, except the old discovery in Santo Domingo.

QUICKSILVER.

By Joseph Struthers.

PRODUCTION.

The production of quicksilver in the United States during 1901 amounted to 29,727 flasks of 76½ pounds, valued at $1,382,305, as compered with 28,317 flasks, valued at $1,302,586, in 1900, an increase in quantity of 1,410 flasks, and in value of $79,719. To the total production during 1901 California contributed 26,720 flasks, Texas 2,932 flasks, and Oregon 75 flasks; and of the 26,720 flasks of quicksilver produced in California, 20,950 flasks were received at San Francisco, the remainder being shipped East.

There was very little variation at San Francisco during 1901 in the price of quicksilver, which ranged from $46 to $48 per flask for domestic, and from $44 to $45 per flask for export.

Prices of quicksilver, per flask, at San Francisco during 1901, by months.

	Highest.	Lowest.	Average.
January	$47.50	$47.00	$47.25
February	47.00	47.00	47.00
March	47.00	46.50	46.75
April	46.50	46.00	46.25
May	47.00	46.50	46.75
June	48.00	47.00	47.50
July	48.00	48.00	48.00
August	$48.00	$46.50	$47.25
September	47.50	47.50	47.50
October	47.50	47.50	47.50
November	47.50	46.50	47.00
December	47.50	47.50	47.50
Average			47.19

The exports from San Francisco during the year amounted to 5,337 flasks, valued at $242,908, practically the entire quantity being shipped to Mexico and Central America. Notwithstanding the increased production of 1,410 flasks, the stock in sight unsold on January 1, 1902, including that at New York, was but 2,230 flasks.

CALIFORNIA.

In California two new mines have been added to the list of producers, the Karl mine and the Libertad mine, both in San Luis Obispo County. The largest producers were the New Idria, in San Benito County; the Napa Consolidated, in Napa County, and the New Almaden, in Santa Clara County, the production of these being about equal. Several of the older mines fell off materially in production, which decrease was offset by the production of several small prospects with retorts. The cost of producing quicksilver from the average California mine, well developed and fully equipped with a modern plant, exceeds $35 per flask; and when to this amount the interest on the cost of the plant and the cost of the development of the mines are added, the prospect for the profitable opening of new mines becomes very discouraging. The average yield of quicksilver in operative mines varies from 0.3 to 0.6 per cent, although under very favorable conditions an ore as low as 0.25 per cent yield can be operated profitably at the present price of quicksilver. The outlook for increased production of quicksilver in California is unpromising; many of the older producers report decreased outputs, and no new mines of importance have been discovered recently.

As California has produced nearly all the quicksilver obtained in the United States, the subjoined table has been compiled to show the total product in that State from 1850 to 1901. In the half century covered by this table the grand total of production has amounted to 1,884,059 flasks of 76½ pounds net, which makes an average of 36,231 flasks per year. Of this amount one mine, the New Almaden, in Santa Clara County, has produced a little over 50 per cent. The greatest activity in the quicksilver mines of California was from 1875 to 1882, when an average of 64,000 flasks a year was produced. Since 1883 the production has approximated but 30,000 flasks a year.

Total product of quicksilver in California from 1850 to 1901, inclusive.

[Flasks of 76½ pounds, net.]

Year.	Production.	Year.	Production.	Year.	Production.
1850	7,723	1868	47,728	1886	29,981
1851	27,779	1869	33,811	1887	[a]33,825
1852	20,000	1870	30,077	1888	33,250
1853	22,284	1871	31,686	1889	26,464
1854	30,004	1872	31,621	1890	22,926
1855	33,000	1873	27,642	1891	22,904
1856	30,000	1874	27,756	1892	27,993
1857	28,204	1875	50,250	1893	30,164
1858	31,000	1876	72,716	1894	30,416
1859	13,000	1877	79,395	1895	36,067
1860	10,000	1878	63,880	1896	30,765
1861	35,000	1879	73,684	1897	26,691
1862	42,000	1880	59,926	1898	31,092
1863	40,531	1881	60,851	1899	29,454
1864	47,489	1882	52,732	1900	26,317
1865	53,000	1883	46,725	1901	26,720
1866	46,550	1884	31,913	Total	1,884,059
1867	47,000	1885	32,073		

[a] Includes 65 flasks from Oregon.

The production of quicksilver in California for 1900 is given below by counties, permission to publish the production by individual mines having been withheld:

Production of quicksilver in California in 1901, by counties.

[Flasks of 76½ pounds, net.]

County.	Production.	Value.
Colusa	235	$10,575
Lake	4,395	211,324
Napa	7,798	388,176
San Benito	4,800	242,300
San Luis Obispo	840	41,513
Santa Clara	5,220	236,608
Sonoma	2,130	95,850
Trinity	1,302	58,668
Total	26,720	1,285,014

TEXAS.

The mining and smelting of quicksilver ore in Texas is being developed at Terlingua, Brewster County, where pockets of cinnabar ore occur in hard Cretaceous limestone and in decomposed bluish shale. Very little mining is carried on underground, by far the greater part of the ore being extracted from open cuts. Practically all of the output during 1901 is to be credited to the Marfa and Mariposa Mining Company, although Parker & McKinney contributed a small quantity.

IMPORTS.

Compared with the total production of quicksilver in the United States the quantity imported during the last nine years has been inconsiderable, as would naturally result from the fact that during this time about one-half of the domestic product has been exported. During the last four years the quantity of quicksilver imported has been merely nominal.

The following table shows the quantity and value of the imports of quicksilver from 1867 to 1901, inclusive:

Quicksilver imported and entered for consumption in the United States from 1867 to 1901, inclusive.

Year ending—	Quantity.	Value.	Year ending—	Quantity.	Value.
June 30—	*Pounds.*		June 30—	*Pounds.*	
1867		$15,248	1885	257,659	$90,416
1868	152	68	Dec. 31—		
1869		11	1886	629,888	249,411
1870	239,223	107,646	1887	419,934	171,431
1871	304,965	137,332	1888	132,850	56,997
1872	370,353	189,943	1889	341,514	162,064
1873	99,898	74,146	1890	802,871	445,807
1874	51,202	52,093	1891	123,966	61,355
1875	6,870	20,957	1892	96,318	40,133
1876	78,902	50,164	1893	41,772	17,400
1877	38,250	19,553	1894	7	6
1878	294,207	135,178	1895	15,001	7,008
1879	519,125	217,707	1896	305	118
1880	116,700	48,463	1897	45,539	20,147
1881	138,517	57,733	1898	81	51
1882	597,898	233,057	1899	131	83
1883	1,552,738	593,367	1900	2,616	1,051
1884	136,615	44,035	1901	1,441	789

EXPORTS.

As stated above, during the last nine years nearly one-half of the total product of quicksilver in the United States has been exported. Since 1880, when the records of the exports of quicksilver were first kept, the exports have usually greatly exceeded the imports, except during the years 1886 and 1890. In the following table the quantity and value of quicksilver exported from the United States are given, the quantities being expressed in flasks of 76½ pounds, net. In previous years nearly all the quicksilver exported was shipped from San Francisco; but during 1901 only 5,479 flasks, of the total of 11,219 flasks exported, were shipped from that port, practically the entire export being consigned to Mexico and Central America.

Exports of quicksilver from the United States from 1880 to 1901, inclusive.

[Flasks of 76½ pounds, net.]

Year.	Quantity.	Value.	Year.	Quantity.	Value.
1880	37,210	$1,119,952	1891	3,714	$145,502
1881	35,107	1,025,299	1892	3,518	133,626
1882	33,875	988,454	1893	16,631	542,410
1883	30,072	808,353	1894	14,408	397,528
1884	7,370	199,685	1895	15,542	482,085
1885	6,802	209,753	1896	19,944	618,437
1886	8,091	204,956	1897	13,173	394,549
1887	11,394	441,112	1898	12,830	440,587
1888	10,684	406,899	1899	16,517	609,586
1889	5,111	213,717	1900	10,172	425,812
1890	2,069	93,192	1901	11,219	475,609

WORLD'S PRODUCTION AND VALUE.

The following table gives the production, in metric tons, and the value of quicksilver in various countries in the years 1898, 1899, and 1900:

World's production and value of quicksilver in 1898, 1899, and 1900.

[Metric tons.]

Country.	1898.		1899.		1900.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
United States	1,079	$1,188,627	1,057	$1,452,745	983	$1,302,586
Austria	491	567,377	536	516,600	510	623,815
Italy	173	173,000	205	246,000	260	312,000
Russia	362	321,754	362	321,814	304	270,256
Spain	1,691	1,593,921	1,361	1,481,229	1,095	1,193,550
Total	3,796	3,844,679	3,521	4,018,388	3,152	3,702,207

LITHIUM.

By Joseph Hyde Pratt.

INTRODUCTION.

During the last few years there has arisen an unusual demand for lithium minerals which can be used as a source of lithium in the manufacture of lithium carbonate. There are but two minerals that have thus far been mined for this purpose, which are lepidolite, a lithia mica, in part a metasilicate of aluminum with potassium and lithium and varying amounts of fluorine and hydroxyl; and spodumene, a metasilicate of aluminum and lithium, generally containing a little sodium. Of these, the former has been the chief source of lithia (Li_2O), although the spodumene contains fully as high a percentage of this oxide.

OCCURRENCE.

The largest deposits of lepidolite that have been found in the United States are near Pala, San Diego County, Cal., which were the largest producers of this mineral during 1901. Considerable development work was done on adjoining claims, which showed the lepidolite to be in quantity. The work exposed, also, some very finely colored tourmalines, which compare favorably with those from Paris, Me., and from Haddam, Conn. On the property of Douglas and Butterfield a large deposit of amblygonite, a fluo-phosphate of aluminum and lithium, has been discovered associated with the lepidolite. This mineral has not as yet been utilized as a source of lithium, but its occurrence, as reported on this property, makes it probable that it will also be used for the manufacture of lithium salts.

The most noted locality where spodumene occurs in quantity is at the Etta group of mines in the Black Hills of South Dakota. Other mines in this vicinity that are known to contain spodumene in some quantity are the Sunday, the Golden Star, the Traction, and the Bob Ingersoll mines. Most of the spodumene shipped from this locality has been from the Etta group of mines.

USES.

It is not the metal lithium that is used in the arts, but its salts, principally lithium carbonate. This is used extensively in the preparation of mineral waters for medicinal purposes and in the manufacture of effervescing lithia tablets.

PRODUCTION.

The production of lithium minerals in 1901, which amounted to 1,750 tons, valued at $43,200, was more than three times the production of 1900, which was about 520 tons. The average price received for these lithium minerals was $24.68 per ton. The price of the lithium minerals varies with the percentage of lithia. The highest recorded price received per ton was $40 and the lowest $11, these figures being for the mineral on board the cars at the mine. The highest price was for lepidolite. All the lepidolite that was mined in California was sent to New York, where a portion of it was subjected to chemical treatment and the rest was shipped to Germany. The spodumene was also shipped to New York and the lithia was converted into the carbonate. None of the spodumene has been shipped abroad. For a number of years all the lithium minerals mined in this country were shipped to Germany, and the lithium carbonate manufactured from them was returned to this country and was sold at from $2 to $4 per pound. These salts are, however, now being manufactured by the Century Chemical Company, Camden, N. J., and the Eos Chemical Company, Rahway, N. J., and there is some talk of establishing a plant on the Pacific coast for their manufacture. The Pacific coast offers a very favorable opportunity for the establishment of a large manufacturing chemical plant which would be in a position to handle these lithium minerals and other minerals occurring in the West that are of value to manufacturing chemists. It is expected that the new claims at Taylor, Cal., which are now being developed, will soon become producers of lepidolite, and that there will be a further increase in the production during 1902 over that of 1901. This may, however, be affected by the fact that some difficulty has been experienced in the commercial reduction of these lithium minerals because of the cost, due to the low percentage of lithium that they contain. If the amblygonite, referred to above, develops into a large deposit, this may become a very profitable source, as its percentage of lithia is much greater than either of the other two lithium minerals.

NICKEL AND COBALT.

By Joseph Hyde Pratt.

INTRODUCTION.

It is better to treat these metals together, because most of the ores that contain one contain at least a small amount of the other, and in the smelting of the ores both the nickel and the cobalt go into the matte which is to be refined. Thus nickeliferous pyrrhotite, which is the most widely spread and abundant of the nickel ores, often contains from one-twentieth to one-thirtieth as much cobalt as nickel. Pyrrhotite is a brownish or grayish-bronze mineral on a fresh fracture, but it tarnishes readily. It is also known as magnetic pyrites, as it is usually magnetic, but varies much in intensity. It is a sulphide of iron, often containing some nickel, which varies from a trace to nearly 6 per cent. As the percentage of nickel increases over this amount, the ore passes through intermediate stages to the mineral pendlandite, a sulphide of iron and nickel, in which the nickel varies from 18 to 39 per cent. This mineral is often found intimately associated in small amounts with pyrrhotite. Millerite, a brass-yellow or bronze-yellow nickel sulphide, is often found associated with the pyrrhotite ores in thin coatings of a radiated, fibrous structure, frequently with a velvety surface of crystals or tufts of radiated needles. Some of the best specimens have been obtained from the Gap mine in Lancaster County, Pa.

The other mineral which is the principal source of nickel is genthite, a resinous, pale apple-green or yellowish mineral. It is an amorphous mineral, often occurring in incrustations, and it is a hydrous nickel-magnesium silicate ($2NiO_2.2MgO.3SiO_2.6H_2O$). It is the garnierite variety of the genthite that is the important ore of nickel. Its color is bright apple-green, shading to pale green, which on exposure to light becomes nearly white. It is very variable in its composition and the mineral that is used as an ore varies from 21 to 45 per cent in nickel oxide. These minerals occur associated with basic magnesian rocks, either the peridotites or their alteration product, serpentine.

The mineral niccolite, a nickel arsenide (NiAs), which is of a pale copper-red color, with a gray or blackish tarnish, is occasionally found in some quantity, but has not as yet been utilized as a source of nickel. Associated with this mineral is gersdorffite, a nickel sulph-arsenide (NiAsS), which is of a silver-white to steel-gray color.

OCCURRENCE.

Since the shutting down of the Gap mine, in Lancaster County, Pa., about ten years ago, there has been no direct mining for nickel or cobalt in the United States, but it has been obtained as a by-product from Mine La Motte, an important lead mine in Missouri. From the matte obtained from the smelting of this ore there is recovered each year from 20,000 to 30,000 pounds of nickel and cobalt.

Pennsylvania.—The Gap Nickel mine of Lancaster County, Pa., is located about 3 miles south of the main line of the Pennsylvania Railroad, a little over 50 miles west of Philadelphia and 15 miles north of the Maryland line. The pyrrhotite ore occurs associated with a basic rock (amphibolite), which is entirely inclosed by mica-schists. As described by Professor Kemp,[a] the amphibolite or hornblendic rock occurs as a great lens, and has probably been derived from gabbro or norite or from peridotite. The rock is an old basic igneous intrusive, which has suffered some squeezing, and which has developed in portions of it a gneissoid structure. The nickeliferous pyrrhotite is found concentrated along the contact of the amphibolite and the mica-schist. This pyrrhotite was held in solution in the molten magma when it was intruded into the country rock, and being one of the more basic minerals it would be among the first to separate out as the mass began to cool. This separation will take place along the outer border of the mass, for there it would cool first, and convection currents would then tend to bring into this outer zone a new supply of material, which would deposit its more basic minerals, which in this case would be pyrrhotite. This Gap mine was worked extensively for about a quarter of a century, from about 1863 to 1880, and during that time it was the only nickel mine worked on this continent. It has been worked to a depth of only 300 feet, but on account of the moderate prices which prevailed for nickel and of the abundant supplies of nickel matte that were obtained from Canada work was discontinued. There are undoubtedly large supplies of ore still remaining in this mine.

North Carolina.—Associated with many of the basic magnesian rocks (peridotites) of North Carolina, traces and small amounts of the nickel minerals, genthite, and garnierite, have been found; but thus far they have not been discovered in sufficient quantity to make them a source of nickel; although a deposit of nickel ore averaging 1.5 per cent nickel is reported near Morgantown, Burke County. They have resulted from the alteration and decomposition of the basic magnesian rocks, and are found as thin green stains or incrustations on other minerals and as thin seams filling the crevices and cracks in the rocks from which they have been leached.

Oregon.—There are similar occurrences of nickel silicate in Oregon,[b] which are found in the basic magnesian rock, saxonite, one of the peridotites. The percentage of nickel ore in these rocks is very much greater than in those of North Carolina, and some ore has been obtained that compares very favorably with the ores of New Caledonia. Thus far, on account of the comparative cheapness of nickel and of the cost of working the Oregon deposits, they have been developed but little, and no regular mining has been instituted. These deposits are on Piney Mountain, in Douglas County, about 3 miles a little north of west from Riddles, a station on the Southern Pacific Railroad; and a high-grade cobalt ore deposit is being developed in the eastern part of the State.

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[a] Am. Inst. Min., Eng., Vol. xxiv, 1895, p. 620.

[b] Colorado Sci. Soc., January 6, 1896.

Washington.—Nickel ore is reported to occur in some quantity in what is known as the Congress mine, in the Upper Nine-mile[a] section, situated about 14 miles north of Keller, Ferry County, Wash. This section was formerly prospected and worked for copper and gold, but was a complete failure, and the claims were abandoned in 1899. All the rocks were plentifully covered with a green stain, but no copper values could be obtained. On being tested, these rocks were found to contain nickel; and in the latter part of 1901 the claims were again taken up and are now being developed for nickel.

Wyoming.—The Wyoming nickel ores, which have been attracting considerable attention during the last few years, are located near Sheridan, Sheridan County, but as far as can be learned the ore does not contain sufficient quantities of nickel to justify working the deposits. At Piney Creek, also, nickel ore is reported.

Nevada.—Near the northern border of Churchill County, in Cottonwood Canyon, which is about 45 miles from Lovelocks, Humboldt County, Nev., deposits of niccolite and gersdorffite have been prospected as to their value as nickel ores. They have been developed by means of an inclined shaft 65 feet deep, with crosscuts from it. On account of the distance of these deposits from the railroad, they have not been producers of any nickel ores, but it is expected that a railroad will be built in the near future to some iron mines in the vicinity, which will make these nickel deposits accessible, and they will then be thoroughly tested as to their actual value as a source of nickel. Deposits have also been reported at Burkeville, Lincoln County, and near Candelaria, Esmeralda County.

Arizona.—There are a number of other localities in the United States in which nickel ores have been discovered. In some of them the ores are said to be in quantity. It is reported that the magnetic mine near Tucson, Ariz., contains these ores in quantity, and that they are now being investigated by Eastern capitalists. They are reported as found also on Spring Creek, in the Black Hills, South Dakota, about 11 miles northwest of Custer, and at the St. Joe mine, Blackbird, Lemhi County, Idaho.

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[a] New York Com., September 6, 1901.

Alaska.—A recent discovery of nickeliferous pyrrhotite is reported near the head of Skowl Arm, in the vicinity of Ketchikan, in southeastern Alaska.[a] The ore occurs in two parallel veins or ledges at the contact of diorite with quartzite.

Nearly all of the nickel used in the United States is obtained from the mines in the Sudbury district, Canada. The ore is a nickeliferous pyrrhotite, and occurs in this district in enormous quantity. The total output of all the mines at the present time is nearly double what it was two years ago, and they produce probably one-half of the nickel used in the world.

The other chief sources of nickel ore are the mines of New Caledonia, an island belonging to France, in the Pacific Ocean, off the east coast of Australia, in which the ore is the garnierite variety of genthite, and the nickel mines in Silesia, which have been making steady progress and are increasing their production at a rapid rate.

Nickel deposits are being developed near Haugesund, in Norway, and the ores have been tested, giving satisfactory results. A considerable amount of these ores have been treated in this country. What is believed to be an extensive deposit of nickel has been discovered on the headwaters of Tulameen River, British Columbia.

As is seen from the above, nickel ores are to be found widely distributed throughout the world, although they are being mined at the present time principally in three localities—the Sudbury district, Canada; New Caledonia, and Silesia. The knowledge, however, that nickel ores do occur in quantity at other localities, will have a restraining influence on any very large increase in the price of nickel.

USES.

The uses of nickel are somewhat varied. The first use was in the manufacture of German silver, or albata, an alloy of zinc, copper, and nickel, which has been used to a large extent in the manufacture of spoons, forks, and other small articles. This use, however, has been somewhat replaced by plating iron with nickel, which gives an effect similar to German silver.

Nickel is also used quite extensively for coinage by the United States and many of the European countries. The coins consist of an alloy of copper and nickel, varying from 88 to 75 per cent of copper and from 12 to 25 per cent of nickel.

The addition of a little magnesium to molten nickel causes the metal to become malleable, and this property has been utilized in the manufacture of nickel into sheets, and also in making sheets composed of an iron plate with a nickel plate welded upon one or both sides of the iron plate, the mass then being rolled to the desired thickness. This sheet metal has been used largely, especially in Europe, for culinary utensils and other objects.

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[a] Min. and Sci. Press, August 24, 1901.

The most important use of nickel is in the manufacture of nickel steel, containing about 3½ per cent of nickel. This is used now in large quantities in the production of armor plates, turrets, propeller shafts, crank shafts, etc. It has also been used in the construction of bicycles.

Nickeloid[a] is a nickel-plated sheet of zinc. It is made from a polished sheet of zinc upon which is plated a deposit of copper. The sheet is then treated electrically to a coating of nickel, and this in turn is highly polished and finished like the ordinary nickel-plated copper. The nickeloid presents a brilliant surface, which is noncorrosive and does not oxidize or rust; and it can be adapted to a variety of manufactured articles made directly from the metal, thus saving the cost of nickel buffing and polishing. It is being used to some considerable extent in the manufacture of reflectors, refrigerator linings, bath tubs, show cases, store signs, etc.

A new nickel alloy has recently been introduced by a Berlin manufacturer,[b] which is composed of nickel, aluminum, and copper, but consists for the most part of aluminum. It is stated that the method of production depends on the fact that the melting point of copper is about a mean between the melting points of the other two metals, and that the aluminum first unites with the copper and this prepares it to take up the nickel. The process depends largely for its success on a special furnace designed by the manufacturer, and also on the condition of certain fluxes. The complete explanation of its manufacture, however, is kept secret. The alloy can be rolled into plates and bars.

A few years ago an alloy of nickel and aluminum was made by Mr. E. S. Sperry, of Bridgeport, Conn.,[c] by melting nickel in a plumbago crucible under a layer of borax and adding at the proper temperature aluminum, the whole mass being stirred by a plumbago stirrer. The alloy immediately became incandescent and boiled. On being poured into the molds and cooled, the resulting alloy was found to be gray in color and not unlike wrought iron, and the fracture was devoid of any crystalline appearance. It was brittle and was readily ground to a powder in the mortar. This alloy, after standing in a covered wooden box for three months, was found to have disintegrated to a dark-gray powder which could not be melted or poured into ingots. This same result has been obtained from alloys made by Mr. A. E. Hunt, of Pittsburg, Pa.,[d] and he obtained the same phenomenon also with a 50 per cent alloy of iron and aluminum, of manganese and aluminum, of chromium and aluminum, and of tin and aluminum.

The physical properties and utility of these alloys in this powdered form have not been thoroughly investigated; when they are, they may yield some practical as well as interesting scientific results.

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[a] The Iron Age, April 11, 1901.

[b] Eng. and Min. Jour., Nov. 23, 1901.

[c] Am. Inst. Min. Eng., Vol. XXIX, 1899, p. 280.

[d] Ibid., p. 1029.

PRODUCTION.

As was stated above, the only nickel and cobalt produced in the United States during 1901 were as by-products from the smelting of lead ores at Mine La Motte, Missouri. The matte containing the nickel and cobalt was refined at Constable Hook and Camden, N. J., and there were obtained 6,700 pounds of nickel and 13,360 pounds of cobalt oxide, as compared with 9,715 pounds of metallic nickel and 6,471 pounds of cobalt oxide produced in 1900. This is a decrease of 3,015 pounds in the production of nickel, and an increase of 6,889 pounds in the production of cobalt oxide.

In the following table are given the production and the value of nickel obtained from domestic ores from 1887 to 1901:

Production of nickel from domestic ores in the United States during the years 1887 to 1901.

Year.	Quantity.	Value.	Year.	Quantity.	Value.
	Pounds.			*Pounds.*	
1887	205,566	$133,200	1895	10,302	$3,091
1888	204,328	127,632	1896	17,170	4,464
1889	252,663	151,598	1897	23,707	7,823
1890	223,488	134,093	1898	11,145	3,956
1891	118,498	71,099	1899	22,541	8,566
1892	92,252	50,739	1900	9,715	3,886
1893	49,399	22,197	1901	6,700	3,551
1894	9,616	3,269			

In the table below is given the production of cobalt oxide in the United States from domestic ores, from 1869 to 1901:

Production of cobalt oxide in the United States, 1869 to 1901.

[Pounds.]

Year.	Quantity.	Year.	Quantity.	Year.	Quantity.
1869	811	1880	7,251	1891	7,200
1870	3,854	1881	8,280	1892	7,869
1871	5,086	1882	11,653	1893	8,422
1872	5,749	1883	1,096	1894	6,763
1873	5,128	1884	2,000	1895	14,458
1874	4,145	1885	8,423	1896	10,700
1875	3,441	1886	8,689	1897	19,520
1876	5,162	1887	[a] 18,340	1898	6,247
1877	7,328	1888	8,491	1899	10,230
1878	4,508	1889	13,955	1900	6,471
1879	4,376	1890	6,788	1901	13,360

[a] Including cobalt oxide in ore and matte.

The recent act passed by the Parliament of the Dominion of Canada (chapter 17 of 60–61 Victoria), giving the governor-general the power to levy an export duty on copper-nickel products in Ontario, is still in force and can go into effect whenever the governor-general shall order it. As was stated in the report for last year, this action of Parliament was due to the fact that all the nickel-copper matte from the Sudbury mines was exported to the United States, where it was refined, and it was expected that this act would force the refining of the matte in Canada. Elaborate experiments have been made by the Canadian Copper Company to refine the matte in Canada, but no practical way has thus far been found, owing to unfavorable conditions existing there. The Mond Nickel Company are experimenting and making plans for the erection of works for the refining of the matte produced in Canada. The process to be used is known as the Mond process, and it is expected that the works when completed will produce from 1,000 to 1,500 tons of nickel.

Below is given a table showing the amount of nickel ore mined and smelted in Canada, and the amount of matte obtained from it for the years 1896–1901, inclusive:

Production of nickel in Canada from 1896 to 1901, inclusive.[a]

Year.	Ore produced.	Ore smelted.	Matte obtained.	Nickel in matte.
	Tons.	*Tons.*	*Tons.*	*Pounds.*
1896	109,097	73,505	9,733	3,897,000
1897	93,155	96,093	14,034	3,998,000
1898	123,920	121,924	21,101	5,567,000
1899	203,118	171,230	19,215	5,744,000
1900	216,695	211,960	23,448	7,080,000
1901	326,945	270,380	45,134	8,882,000

[a] As reported by the Director of the Bureau of Mines, Ontario, Canada.

IMPORTS AND EXPORTS.

In the tables below are given the amount and value of cobalt oxide and nickel imported into the United States since 1868, the greater part of the nickel having been obtained from the Sudbury mines:

Colbalt oxide imported and entered for consumption in the United States, 1868 to 1901.

Year ending—	Oxide.		Year ending—	Oxide.	
	Quantity.	Value.		Quantity.	Value.
June 30—	*Pounds.*		Dec. 31—	*Pounds.*	
1868	....	$7,208	1886	19,366	$29,543
1869	....	2,330	1887	26,882	39,396
1870	....	5,019	1888	27,446	46,211
1871	....	2,766	1889	41,455	82,332
1872	....	4,920	1890	33,338	63,202
1873	1,480	4,714	1891	23,643	43,188
1874	1,404	5,500	1892	32,833	60,067
1875	678	2,604	1893	28,884	42,694
1876	4,440	11,180	1894	24,020	29,857
1877	19,752	11,056	1895	36,155	39,839
1878	2,860	8,693	1896	27,180	36,212
1879	7,531	15,208	1897	24,771	34,773
1880	9,819	18,457	1898	33,731	49,245
1881	21,844	13,837	1899	46,791	68,847
1882	17,758	12,764	1900	54,073	88,651
1883	13,067	22,323	1901	71,969	134,208
1884	25,963	43,611			
1885	16,162	28,138			

Nickel imported and entered for consumption in the United States from 1868 to 1901.

Year ending—	Nickel.		Nickel oxide, alloy of nickel with copper, and nickel matte.		Total value.
	Quantity.	Value.	Quantity.	Value.	
June 30—	*Pounds.*		*Pounds.*		
1868		$118,058			$118,058
1869		134,327			134,327
1870		99,111			99,111
1871	17,701	48,133	4,438	$3,911	52,044
1872	26,140	27,144			27,144
1873	2,842	4,717			4,717
1874	3,172	5,883			5,883
1875	1,255	3,157	12	36	3,193
1876			156	10	10
1877	5,978	9,522	716	824	10,346
1878	7,486	8,837	8,518	7,847	16,684
1879	10,496	7,829	8,314	5,570	13,399
1880	38,276	25,758	61,869	40,311	66,069
1881	17,933	14,503	135,744	107,627	122,130
1882	22,906	17,924	177,822	125,736	143,660
1883	19,015	13,098	161,159	119,386	132,484
1884			[a]194,711	129,733	129,733
1885			105,603	64,166	64,166
Dec. 31—					
1886			277,112	141,546	[b]141,546
1887			439,037	205,232	[c]205,232
1888			316,895	138,290	[d]138,290
1889			367,288	156,331	[e]156,331
1890	[f]566,571	260,665	247,299	115,614	376,279
1891	355,455	172,476	[g]10,245,200	148,687	321,163
1892			[h]4,487,890	428,062	428,062
1893			[h]12,427,986	386,740	386,740
1894			[h]9,286,733	310,581	310,581
1895			[h]20,355 749	629,910	629,910
1896			[h]23,718,411	620,425	620,425
1897			[h]27,821,232	781,483	781,483
1898			[h]60,090,240	1,534,262	1,534,262
1899			[h]44,479,841	1,216,253	1,216,253
1900			[i]57,500,800	1,183,884	1,183,884
1901			[j]117,364,337	[j]1,849,620	1,849,620

[a] Including metallic nickel.

[b] Including $465 worth of manufactured nickel.

[c] Including $879 worth of manufactured nickel.

[d] Including $2,281 worth of manufactured nickel.

[e] Including $131 worth of manufactured nickel.

[f] Classified as nickel, nickel oxide, alloy of any kind in which nickel is the element or material of chief value.

[g] Classified as nickel and nickel matte.

[h] Includes all nickel imports except manufactures; nearly all of this is nickel in matte from Canada containing about 20 per cent nickel.

[i] Ore and matte; in addition 455,188 pounds of nickel, nickel oxide, etc., were imported, valued at $139,786.

[j] Including $209,956, the value of imports of 635,697 pounds of nickel, nickel oxide, alloy, etc., and $2,498, the value of imported manufactures of nickel, not specially provided for.

Exports of nickel oxide and matte from the United States from 1894 to 1901.

Year.	Quantity.	Value.	Year.	Quantity.	Value.
	Pounds.			*Pounds.*	
1894[a]	1,235,588	$247,568	1898	5,657,620	$1,359,609
1895	1,061,285	239,897	1899	5,004,377	1,151,454
1896	2,756,604	600,883	1900	5,869,906	1,382,727
1897	4,255,558	997,391	1901	5,869,655	1,521,291

[a] Latter six months; not separately classified prior to July 1, 1894.

FOREIGN PRODUCTION.

The users of nickel in the United States are vitally interested as to whether or not the act passed by the Canadian parliament will be enforced; for if this act should be enforced the United States would have to look to other sources for her supply of nickel. This would lead undoubtedly to the production of nickel to some extent in this country, but at first it would have to be obtained, in part at least, from outside. In the table below is given the production of nickel in Canada, France, and Germany (which are the principal producers) from 1889 to 1900. In comparing this table of production with that of the nickel imported into the United States, it should be remembered that in the latter table the quantity of nickel matte is given.

Production of nickel in Canada, France, and Germany from 1889 to 1900.

Year.	Canada.		France.		Germany.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Pounds.		*Metric tons.*		*Metric tons.*	
1889	830,477	$498,286	330	$324,900	282	$279,680
1890	1,435,742	933,232	330	317,300	434	436,430
1891	4,626,627	2,775,976	330	319,200	594	644,480
1892	2,413,717	1,399,956	1,244	1,174,580	747	698,630
1893	3,992,982	2,076,351	2,045	1,175,720	893	774,630
1894	4,907,430	2,061,120	1,545	1,175,720	522	449,350
1895	3,888,525	1,360,984	1,545	1,033,220	698	575,890
1896	3,397,113	1,188,990	1,545	875,330	822	666,900
1897	3,997,746	1,399,137	1,245	704,425	898	710,980
1898	5,517,690	1,820,838	1,540	887,800	1,108	670,482
1899	5,744,000	2,067,840	1,740	1,003,600	1,115	669,517
1900	7,080,000	3,327,707	1,700	1,020,000	1,989	1,999,940

The production of nickel in the form of matte, oxide, etc., in Canada in 1901 was 9,189,047 pounds, valued at $4,594,523.

THE INTERNATIONAL NICKEL COMPANY.

A very important step in the development of the nickel industry was made early in April, 1902, by the organization, under the laws of New Jersey, of the International Nickel Company, which resulted from plans to consolidate and control the nickel production of the world. The capitalization of the International Nickel Company consists of $12,000,000 common stock, $12,000,000 preferred stock carrying 6 per cent dividends noncumulative, and $12,000,000 of 5 per cent thirty-year gold bonds. Of this capital, provision was made for the present issue of $9,000,000 of preferred stock, $9,000,000 of common stock, and $10,000,000 of bonds to cover acquisition of the entire capital stock of the following properties in the United States, Canada, and New Caledonia: The Canadian Copper Company; the Orford Copper Company, with reduction works at Bayonne, N. J.; the Anglo-American Iron Company, and the Vermilion Mining Company in Canada; the American Nickel Works in Camden, N. J.; the Nickel Corporation, Limited, and the Société Minière Caledonienne in New Caledonia. The directors are: Robert M. Thompson, Ambrose Monell, E. C. Converse, J. R. De Lamar, Leslie D. Ward, Joseph Wharton, Millard Hunsiker, Archibald W. Maconochie, and Max Pam; the executive committee consists of Robert M. Thompson, Ambrose Monell, J. R. De Lamar, E. C. Converse, and Max Pam. The officers are: Robert M. Thompson, chairman of the board; Ambrose Monell, president; J. R. De Lamar, vice president; Joseph Claudet, treasurer; Stephen H. P. Pell, secretary; Max Pam, general counsel. Of the directors, Mr. Hunsiker and Mr. Maconochie live in London. The Société le Nickel, owning extensive properties in New Caledonia and a reduction plant in France, is not included in the combination, although it is believed that an understanding exists between them which will regulate the production and price of nickel, together with the apportionment of the trade. Other companies owning properties in the Sudbury district, Canada, not in the combination are: The Mond Nickel Company, with a refining plant in England; the Lake Superior Power Company, with a refinery in course of construction at Sault Ste. Marie, and the Nickel Copper Company, of Ontario, with a refining plant at Hamilton. The extended use of nickel explains the interest in the International Nickel Company taken by the United States Steel Corporation, although no official connection exists between the two companies.

In Germany the firm of Basse & Selve produces nickel from Norwegian and New Caledonian ores, and occasionally from copper matte. In addition to this firm there are one or two refineries of lesser importance. The International Nickel Company and the Société le Nickel will control, in the near future, by far the greater part of the production of metallic nickel in the world.

ANTIMONY.

By Joseph Struthers.

INTRODUCTION.

Antimony is used chiefly for making alloys with lead, tin, zinc, and other metals. The addition of a small quantity of antimony to lead hardens it and causes it to expand at the moment of solidification, yielding a casting with clean, sharp faces, which is of special value in the manufacture of type. The most important alloys of antimony are: Type metal, composed of lead and antimony, with or without the addition of tin; hard lead, produced in refining antimonial lead, containing generally about 25 per cent antimony; britannia metal and pewter, used extensively for tableware, the former being an alloy of tin with from 10 per cent to 16 per cent antimony and 3 per cent copper, and the latter an alloy of tin with a smaller content of antimony; antifriction metal, also called white metal and babbitt metal, which consists of antimony and tin, with the addition of small quantities of lead, copper, zinc, bismuth, and nickel.

The principal salts of antimony are tartar emetic, an antimony-potassium tartrate, used in medicine, and in dyeing as a mordant for vegetable fiber; antimony cinnabar, a fiery red colored pigment used in oil painting, consisting of antimony trisulphide with a small amount of antimony trioxide; and antimony pentasulphide, used as a red pigment for vulcanizing rubber.

Practically the only antimony ore of present commercial importance in the United States is the mineral stibnite, antimony trisulphide (Sb_2S_3). During 1901 the domestic production of antimony ore amounted to a few hundred tons, derived from Idaho, South Dakota, and California. There are many antimony deposits in other Western States, but on account of the present condition of the industry and the high transportation charges to smelting centers, they can not be operated with profit.

PRODUCTION.

The sources of the supply of antimony for consumption in the United States are four in number, here given in the order of their importance:

1. Hard lead derived from the smelting of foreign and domestic lead ores.

2. Imported regulus or metal.
3. Imported antimony ores.
4. Domestic antimony ores.

The amount of hard or antimonial lead produced from foreign and domestic lead ores in 1901 was 17,878,000 pounds, containing approximately 4,469,500 pounds of antimony. This material is used for the manufacture of the various alloys, and is obviously a source of supply of antimony.

The amount of antimony metal imported during 1901 as regulus or metal was 3,674,923 pounds, valued at $255,346.

The imports of antimony ore in 1901 amounted to 1,731,956 pounds, valued at $24,256, with an antimony content varying from 35 to 65 per cent. The average percentage of antimony in all ores imported may be taken at 52.5, and if a smelting extraction of 42 per cent is assumed, the amount of antimony derived from this source of supply was 727,421 pounds.

During 1901 approximately about 100 tons of domestic antimony ores were smelted at San Francisco, Cal., yielding 50 tons of antimony. As in previous years, the quantity of antimony metal derived from domestic antimony ores continues to be an insignificant factor in the total production.

The aggregate amount of antimony available as metal or in alloy from the above-mentioned sources in 1901 is estimated at 8,971,844 pounds, valued on the basis of the average price for the year, at $919,614.

The control of the production and trade of antimony continues to remain in the hands of Mathison & Co., of London, with works at Chelsea, Staten Island, N. Y., and of the affiliated concern, the Chapman Smelting Company, with works in San Francisco. Practically all of the domestic ore smelted is treated at the San Francisco works, which refines as well antimony regulus imported from Japan.

The annual production of antimony in the United States from 1880 to 1901 is shown in the following table:

Production of metallic antimony from domestic and foreign ores and that contained in hard lead in the United States from 1880 to 1901, inclusive.

Year.	Contained in hard lead.[a]		Produced from foreign and domestic ores.		Total.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Short tons.		*Short tons.*		*Short tons.*	
1880	(b)	....	50	$10,000	....	....
1881	(b)	....	50	10,000	....	....
1882	(b)	....	60	12,000	....	....
1883	(b)	....	60	12,000	....	....
1884	(b)	....	60	12,000	....	....
1885	(b)	....	50	10,000	....	....
1886	(b)	....	35	7,000	....	....

[a] Estimated at 25 per cent of the total quantity of hard lead produced from both foreign and domestic ores.

[b] No statistics available.

Production of metallic antimony from domestic and foreign ores and that contained in hard lead in the United States from 1880 to 1901, inclusive—Continued.

Year.	Contained in hard lead.[a]		Produced from foreign and domestic ores.		Total.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Short tons.		*Short tons.*		*Short tons.*	
1887	([b])	....	75	$15,000	....	....
1888	([b])	....	100	20,000	....	....
1889	([b])	....	115	28,000	....	....
1890	809	$136,752	129	40,756	938	$177,508
1891	1,011	170,950	278	47,007	1,289	217,957
1892	1,260	219,950	metallic 150 ore 380	56,466	1,790	276,416
1893	1,253	225,540	250	45,000	1,503	270,540
1894	1,187	213,706	200	36,000	1,387	249,706
1895	1,563	236,169	[c]450	68,000	2,013	304,169
1896	1,877	263,249	[c]601	84,290	2,478	347,539
1897	2,217	320,356	[c]844	121,944	3,061	442,300
1898	2,118	348,051	[c]1,120	184,050	3,238	532,101
1899	1,586	307,314	[c]1,275	251,875	2,861	559,189
1900	2,476	490,916	[c]1,750	346,980	4,226	837,896
1901	2,235	457,150	[c]414	84,870	2,649	542,020

[a] Estimated at 25 per cent of the total quantity of hard lead produced from both foreign and domestic ores.

[b] No statistics available.

[c] Principally from imported ores.

The following table, showing the output and value of antimony metal of the world in 1900, has been compiled from the official governmental reports of the respective countries:

World's product of antimony metal in 1900.

Country.	Quantity.	Value.	Country.	Quantity.	Value.
	Short tons.			*Short tons.*	
United States	1,750	$346,980	Italy	1,065	$154,360
Austria-Hungary	907	137,914	Japan	347	56,538
France[a]	1,427	246,080	Total	8,495	1,415,622
Germany	3,029	473,750			

[a] Includes product of Algeria.

CONSUMPTION.

The consumption of antimony in the United States from 1880 to 1901 is given in the subjoined table, the imported ore being estimated to contain an average of 52½ per cent antimony, of which 42 per cent is extractable by smelting operations. Crude antimony, which is refined or concentrated ore and not metal, is included in the quantity of ore imported. Antimony regulus is taken as equivalent to the metal. The antimony contained in hard lead is calculated at 25 per cent.

Estimated consumption of antimony in the United States from 1880 to 1901, inclusive.

Year.	Contained in hard lead.	From domestic ores.	From imported ores and crude antimony.	Imported metal or regulus.	Total.
	Short tons.	*Short tons.*	*Short tons.*	*Short tons.*	*Short tons.*
1880	....	50	7	1,010	[a]1,067
1881	....	50	221	904	[a]1,175
1882	....	60	292	1,263	[a]1,615
1883	....	60	183	1,532	[a]1,775
1884	....	60	61	890	[a]1,011
1885	....	50	57	1,290	[a]1,397
1886	....	35	58	1,499	[a]1,592
1887	....	75	95	1,277	[a]1,447
1888	....	100	18	1,407	[a]1,525
1889	....	115	38	1,338	[a]1,491
1890	....	129	160	1,658	[a]1,947
1891	1,011	278	377	1,309	2,975
1892	1,260	150	50	1,975	3,435
1893	1,253	250	30	1,390	2,923
1894	....	200	100	1,327	[a]1,627
1895	....	[b]275	[b]175	1,750	[a]2,200
1896	1,877	[b]291	[b]310	1,288	3,766
1897	2,217	[b]245	[b]599	1,141	4,202
1898	2,118	[b]250	[b]870	1,052	4,290
1899	1,586	234	1,041	1,495	4,356
1900	2,476	151	1,599	1,827	6,053
1901	2,235	50	364	1,837	4,486

[a] Not including antimony contained in hard lead, for which statistics are not available.

[b] Separation estimated. All antimony smelted, whether from domestic or foreign ores, was reported as of domestic production.

The decrease in the total quantity of antimony estimated to have been consumed in the United States in 1901 as compared with 1900 was due to the very large overimportation of antimony ore and, to a lesser extent, of antimony regulus in 1900. The above table shows the constantly increasing amount of antimony obtained from foreign ores from 1893 to 1900, inclusive, which has been due mainly to the cheap ocean freight rates from foreign countries where the ores are mined at a low cost.

IMPORTS.

The subjoined table gives the quantity and value of antimony ore (including crude antimony) and metallic antimony (regulus) imported into the United States from 1867 to 1901. These statistics were obtained from the Bureau of Statistics of the Treasury Department. An inspection of the table shows that the quantity of ore imported has increased from 116,495 pounds in 1893 to the maximum quantity of 6,089,134 pounds in 1900, a year in which there was a marked overimportation of both ore and metal. In 1901 the importation of antimony ore was 1,731,956 pounds, valued at $24,256.

Antimony and antimony ore imported and entered for consumption in the United States from 1867 to 1901, inclusive.

Year ending—	Metal and regulus.		Crude antimony and ore.		Total value.
	Quantity.	Value.	Quantity.	Value.	
	Pounds.		*Pounds.*		
June 30, 1867	....	$63,919	....	....	$63,919
1868	1,033,336	83,822	....	....	83,822
1869	1,345,921	129,918	....	....	129,918
1870	1,227,429	164,179	....	....	164,179
1871	1,015,039	148,264	....	$2,364	150,628
1872	1,933,306	237,536	....	3,031	240,567
1873	1,166,321	184,498	....	2,941	187,439
1874	1,253,814	148,409	....	203	148,612
1875	1,238,223	131,360	6,460	609	131,969
1876	946,809	119,441	8,321	700	120,141
1877	1,115,124	135,317	20,001	2,314	137,631
1878	1,256,624	130,950	20,351	1,259	132,209
1879	1,380,212	143,099	34,542	2,341	145,440
1880	2,019,389	265,773	25,150	2,349	268,122
1881	1,808,945	253,054	841,730	18,199	271,253
1882	2,525,838	294,234	1,114,699	18,019	312,253
1883	3,064,050	286,892	697,244	11,254	298,146
1884	1,779,337	150,435	231,360	6,489	156,924
1885	2,579,840	207,215	215,913	7,497	214,712
Dec. 31, 1886	2,997,985	202,563	218,366	9,761	212,324
1887	2,553,284	169,747	362,761	8,785	178,532
1888	2,814,044	248,015	68,040	2,178	250,193
1889	2,676,130	304,711	146,309	5,568	310,279
1890	3,315,659	411,960	611,140	29,878	441,838
1891	2,618,941	327,307	1,433,531	36,232	363,539
1892	3,950,864	392,761	192,344	7,338	400,099
1893	2,780,432	243,341	116,495	5,253	248,594
1894	2,653,487	193,988	375,468	[a] 18,805	212,793
1895	3,499,901	223,968	668,610	14,718	238,686
1896	2,576,371	158,975	1,180,828	21,402	180,377
1897	2,282,245	143,370	3,719,186	55,400	198,770
1898	2,103,599	148,671	3,749,222	50,256	198,927
1899	2,990,915	241,685	3,968,654	47,427	289,112
1900	3,654,822	287,937	6,089,134	75,866	363,803
1901	3,674,923	255,346	1,731,956	24,256	279,602

[a] Includes $737, value of ground antimony for which no quantity was given.

There was an export in 1901 of 49,655 pounds of antimony ore, valued at $1,536.

PRICES.

From 1893 to July, 1897, there was a steady decline in the price of antimony, which dropped from 16 cents per pound for Cookson's brand to 7 cents. Beginning with August, 1897, the price began to advance, and in May, 1899, it reached 12 cents per pound, and then remained nearly constant throughout the rest of the year. During 1901 there was a slight falling off in price, and the year closed with Cookson's at 10¼ cents per pound. The tables below show, by months and years, the ruling prices of the several brands of antimony, as reported to The Iron Age, from 1893 to 1901, inclusive:

Prices of antimony at New York from 1893 to 1901, inclusive, by months.

[Cents per pound].

Mouth.	1893.			1894.			1895.		
	Cookson's.	L. X.	Hallett's.	Cookson's.	L. X.	Hallett's.	Cookson's.	Hallett's.	Japanese.
January	11	10½	10¼	10¼	9⅛	9½	8½ to 8⅝	7⅛ to 7¼	....
February	10¾	10½	9⅞ to 10	10	8⅞	9⅜	8¼ to 8½	7⅛ to 7¼	....
March	10¾	10 to 12	10	10⅛	8⅞	9½	8¼	7⅛ to 7¼	....
April	10¾	10⅜	10	10⅛	8⅞	9⅜	7⅞ to 8⅛	7 to 7⅛	6⅞ to 7
May	10½	10¼	10	10⅛	8¾	9¼	7⅞ to 8	7	6⅞
June	10½	10¼	9⅞	9¾	8⅝	9⅛	7⅞ to 8	7 to 7⅛	6⅞
July	10⅜	10⅛	9⅞	10	8⅜	8¾	8 to 8⅛	7⅛ to 7¼	7
August	10¼	10	9¾	10	8¼	8⅞	8	7⅛	7
September	10¼	10	9¾	9½	7⅝	8⅞	8	7⅛	6⅞ to 7
October	10¼	10	9¾	9⅝	7½	8¼	7¾ to 8	7 to 7⅛	6⅞
November	10	9¾	9⅜	8½	7⅜	8¼	7¾ to 7⅞	7	6¾ to 6⅞
December	10⅛ to 10¼	9½ to 9⅝	9⅛ to 9¼	8⅜	7⅜	8⅛	7¾ to 7⅞	6⅞ to 7	6¾ to 6⅞

Month.	1896.			1897.			1898.		
	Cookson's.	Hallett's.	Japanese.	Cookson's.	Hallett's.	Japanese.	Cookson's.	Hallett's.	Japanese.
January	8¼	7¼ to 7½	7	7¼ to 7½	6½ to 6¾	6⅜ to 6⅝	8 to 8¼	7⅛ to 7¼	7⅛ to 7
February	8¼	7½	7	7¼ to 7½	6⅝ to 6⅞	6½ to 6¾	8 to 8¼	7¼ to 7½	....
March	8¼	7½	7	7¼ to 7½	6¾ to 7⅛	6⅝ to 7	8 to 8⅛	7⅝ to 7¾	....
April	8¼	7½	7	7¼ to 7½	7 to 7⅛	7 to 7⅛	8⅛ to 9	7¾ to 8	....
May	8 to 8¼	7¼ to 7½	6⅞ to 7	7¼ to 7⅝	7 to 7¼	6¾ to 7¼	9¼ to 9½	8⅜ to 8¾	8¾
June	8	7¼	6⅞ to 7	7¼ to 7½	6½ to 7	6½ to 6¾	9¼ to 9¾	8¾ to 9	8¾ to 9
July	8	7¼	6⅞ to 7	7 to 7¾	6⅞ to 7½	6¾	9⅝ to 9¾	9	9
August	8	7¼	6⅞ to 7	7 to 8¼	7⅜ to 7½	6¾ to 7	9⅝ to 9¾	9	9
September	8	7¼	6⅞ to 7	8 to 8¼	7¼ to 7½	7 to 7¼	9⅝ to 9¾	9	9
October	7¼ to 7⅜	6½	6⅜	8 to 8½	7¼ to 7½	7 to 7⅛	9⅝ to 9¾	9	9
November	7⅛ to 7⅜	6⅜ to 6½	6¼ to 6⅜	8 to 8½	7¼ to 7½	7 to 7¼	9⅝ to 9¾	9	8⅞ to 9
December	7¼ to 7½	6½	6⅜	8 to 8¼	7¼ to 7⅜	7 to 7¼	9⅝ to 9¾	8¾ to 9	8¾ to 8⅞

Month.	1899.			1900.		1901.		
	Cookson's.	Hallett's.	United States.	Cookson's.	Hallett's.	Cookson's.	Hallett's.	Others.
January	10 to 10⅝	9½ to 9¾	9½	10½ to 11	9¾ to 9⅞	10¼ to 10½	9¼	8⅜ to 9
February	10¼ to 10¾	9½ to 10¼	9½ to 9¾	10½ to 11	9¾ to 10	10¼	9¼	8¾ to 9
March	11½ to 12	10½ to 10¾	10¼ to 10¾	10½ to 11	9¾ to 10	10¼	8¼ to 9¼	8½ to 9
April	11½ to 12	10½ to 10¾	10¼ to 10¾	11	9¾	10¼	8¾ to 9	8½ to 8¾
May	11½ to 12	10½ to 10¾	10¼ to 10½	11	9¾	10¼	8¾ to 9	8½ to 8¾
June	11½	10½	10¼	11	9⅝	10¼	8¾	....
July	11½	10½	10¼	10½ to 11	9½ to 9⅝	10¼	8¾	....
August	11½	10½	10¾ to 11	10½	9½	10¼	8½ to 8¾	8¼ to 8½
September	11½	10½	10¾ to 11	10½	9½	10¼	8½ to 8¾	8¼ to 8½
October	11½	10½	10¼	10½	9½	10¼	8⅜ to 8½	8 to 8¼
November	11¼ to 11½	10¼ to 10½	10 to 10½	10½	9½	10¼	8⅜	8 to 8¼
December	11¼ to 11½	10¼ to 10½	10 to 10¼	10½	9½	10¼	8¼ to 8⅜	8 to 8¼

ARSENIC.

By Joseph Struthers.

PRODUCTION.

Among the new industries that have been developed recently in the United States is the manufacture of arsenious oxide, which was taken up during 1901 by the Puget Sound Reduction Company, at Seattle, Wash., and an output of 300 short tons was placed on the market. Previous to 1901 the world's supply of arsenic and arsenious compounds was derived almost entirely from the mines in Cornwall and Devon, England, and at Freiberg, Germany. In 1899 the world's production of arsenic, arsenious acid, and arsenic sulphide amounted to 7,858 metric tons, or 17,323,097 pounds, valued at $643,267, and in 1900 the production amounted to 8,147 metric tons, or 17,955,888 pounds, valued at $713,771, as is shown in the following table:

The world's production of arsenic for the six years, 1895–1900, inclusive.[a]

[Metric tons.]

Year.	Canada.		Germany.[b]		Italy.[b]		Japan.	Portugal.		Spain.[c]		United Kingdom.[d]	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Tons.		*Tons.*		*Tons.*		*Tons.*	*Tons.*		*Tons.*		*Tons.*	
1895...	*Nil.*	......	3,005	$207,187	100	$8,000	7	......	......	184	$18,390	4,875	$260,990
1896...	*Nil.*	......	2,632	221,165	320	24,400	6	......	......	271	27,100	3,674	227,115
1897...	*Nil.*	......	2,987	295,897	200	18,600	13	524	$20,369	244	29,256	4,232	373,975
1898...	*Nil.*	......	2,677	253,528	215	15,700	7	751	41,764	111	13,320	4,241	268,935
1899...	52	$4,842	2,423	267,250	304	26,483	5	1,083	61,356	101	12,156	3,890	271,180
1900...	275	22,725	2,414	263,250	126	12,098	5	1,031	62,522	150	18,036	4,146	335,140

[a] From official reports of the respective countries.
[b] Metallic arsenic and arsenious acid.
[c] Arsenic sulphide.
[d] Arsenious acid.

The occurrence of arsenic is widely distributed in nature, but only in a few localities is it in sufficient amount to be of commercial value. It occurs most frequently in combination with iron and sulphur, forming the mineral arsenopyrite, commonly called "mispickel." In combination with sulphur alone it occurs as realgar (As_2S_2) and orpiment (As_2S_3); and at Nagy Ag in Transylvania, Hungary, it is found in the metallic condition.

The domestic resources of arsenical ore are so large and widespread that the manufacture of arsenic and its compounds should be developed in the United States to take the place of the large amounts that are imported from Europe and Canada. The importance of arsenic in the manufacturing industries of the United States may be appreciated from the statistics of imports given in the subjoined table:

Imports of metallic arsenic, white arsenic (arsenious acid), and arsenic sulphides (orpiment and realgar) in the United States from 1893 to 1901.

Year.	Quantity.	Value.	Year.	Quantity.	Value.
	Pounds.			*Pounds.*	
1893	6,092,377	$180,333	1898	8,686,681	$370,317
1894	7,063,442	218,636	1899	9,040,871	386,791
1895	6,984,273	237,747	1900	5,765,559	265,500
1896	5,813,387	215,281	1901	6,989,668	316,535
1897	7,242,004	352,284			

The price for white arsenic at New York during 1901 varied from 4.5 cents a pound in January to 3.5 cents in December, the monthly average for the year being 3.92 cents. Red arsenic was quoted at 7.25 cents a pound in January and February, and at 7 cents for the remainder of the year, the average for the year being 7.04 cents a pound.

During the last four years arsenious acid has been manufactured at Deloro, Ontario, Canada, mainly to supply the demands of consumers in the United States. The output amounted to 52 metric tons (114,608 pounds), valued at $4,842, in 1899; to 275 tons (606,000 pounds), valued at $22,725, in 1900, and to 631 tons (1,390,000 pounds), valued at $41,676, in 1901.

BISMUTH.

By JOSEPH STRUTHERS.

PRODUCTION.

The production of bismuth ore in the United States in 1901 amounted to 318.6 short tons, as compared with 220 short tons in 1900. Colorado supplied the entire output, Lake County contributing 253.6 tons, carrying from 4 to 10 per cent bismuth, and Ouray County 65 tons, which varied in bismuth contents from 6 to 12 per cent. The ore averaged from 1 to 2 ounces gold and from 5 to 6 ounces silver per ton, for which the producers were paid. The price for the bismuth content varied from $8 to $11 per unit. The demand for metallic bismuth is limited, and producers in this country are little inclined to report the details of annual production and market conditions. As nearly as can be ascertained, the value of the 318.6 tons was $25,488, less deductions for transportation and treatment charges, or an average of $80 per ton. The ore was purchased by the Leadville Sampler, at Leadville; the State Ore Sampling Works, at Denver; or was shipped direct to Johnson, Matthey & Co., Limited, England.

The world's supply of metallic bismuth is controlled by the combined interests of Johnson, Matthey & Co., Limited, and the Government of Saxony, who regulate absolutely the production and the prices of the metal and its ores. It is stated that the supply of this metal greatly exceeds the demand, and this condition has necessitated a combination of interests in order to maintain the price at a figure which would be remunerative to mine owners. The schedule of prices for ore is based on the market price of metal, and with the latter at $1.25 a pound the following prices were paid on delivery at the smelting works, all deductions for treatment having been made: Ten per cent ore, $150 per ton; 15 per cent ore, $250 per ton; 20 per cent ore, $350 per ton; 30 per cent ore, $550 per ton; 40 per cent ore, $750 per ton; 50 per cent ore, $1,000 per ton.

The imports of bismuth into the United States in 1901 were 165,182 pounds, valued at $239,061, against 180,433 pounds, valued at $246,597, in 1900. In addition to this there was a small importation of bismuth in medicinal preparations.

The monthly average wholesale prices per pound for the metal, f. o. b. works, during 1901 were: January to March, $2.25; April to June, $2.05; July and August, $2.02½; September, $1.64; October to December, $1.50.

The occurrence of bismuth is widespread, and it is found in both the combined and the free state in many of the Western States. The principal bismuth minerals occurring in Colorado are bismuth carbonate, which is found in Lake, Larimer, Boulder, and Chaffee counties; native bismuth, in Summit, Jefferson, Boulder, and Larimer counties; bismuth tellurate and telluride, in Boulder and Ouray counties; and sulpho-bismuthite, in Park, Custer, Ouray, Hinsdale, Clear Creek, La Plata, Boulder, San Juan, and Lake counties.

TUNGSTEN, MOLYBDENUM, URANIUM, AND VANADIUM.

By Joseph Hyde Pratt.

INTRODUCTION.

The metals tungsten, molybdenum, uranium, and vanadium are still attracting considerable interest in the steel industry, on account of the beneficial properties which they impart to steel, although the alloys ferro-uranium and ferro-vanadium are still in the experimental stage as to their actual commercial value. The ferro-alloys of molybdenum and tungsten have passed this stage. There has been no increase in the demand for or use of tungsten during 1901, but for molybdenum the demand has greatly increased. The market value of these metals has fluctuated widely during the last year, with the exception of molybdenum, the value of which has remained nearly constant.

TUNGSTEN.

Although tungsten minerals have been known for a long time, as has also the value of this metal for making alloys, it is only within the last few years that there has been any considerable demand for it. The sources of tungsten are the three minerals, scheelite, wolframite, and hübnerite. Of these, the one that can be used most advantageously in reducing it to the metal, or ferro-alloy, is scheelite, a tungstate of calcium, whose composition is represented by the formula $CaWO_4$. It is a very heavy, white to yellowish-white mineral, with an adamantine to vitreous luster. It crystallizes in tetragonal pyramidal crystals, but is more commonly found massive. Thus far this ore of tungsten has been found in but few localities, and in only one in the United States in which it is in sufficient quantity to be a source of this metal.

Wolframite, which is the most abundant of the tungsten ores, is a dark-gray to grayish-black mineral, with a submetallic to resinous luster. It crystallizes in the monoclinic system, and is often found in terminated crystals. It is very brittle and has a pinacoidal cleavage. Its chemical composition is represented by the formula $(FeMn)WO_4$, a tungstate of iron and manganese.

Hübnerite is very similar to wolframite, but it usually occurs in bladed forms with rarely terminated crystals, and has a brownish-red to nearly black color. Its chemical composition differs from that of wolframite in that the iron has been largely replaced by manganese, and it is essentially a manganese tungstate, $MnWO_4$.

These two latter tungsten minerals occur abundantly at a number of widely separated localities, and at the present time the source of supply greatly exceeds the demand.

OCCURRENCE.

For a number of years tungsten ores have been obtained from England, Austria-Hungary, Saxony, Germany, and Australia, and practi. cally all the tungsten used in the United States was imported. The recent discoveries that have been made of tungsten minerals in this country, however, have shown that they can be produced in quantity in the United States, and that instead of being imported they can be exported. The greater number of localities where these minerals have been found are in the Western States, the principal deposits being in Arizona, Nevada, and Colorado. Deposits have also been found in Oregon, Washington, Idaho, Montana, New Mexico, South Dakota, and in the Eastern States, Connecticut and North Carolina. In Arizona the deposits in the Arivaca district, Pima County, and in the Dragoon Mountains, Cochise County, are still attracting considerable attention, and it has been shown that the tungsten ores can be obtained in quantity. A new occurrence has recently been opened up 60 miles south of Hackberry, Mohave County. A seam of wolframite from 2 to 6 inches in thickness occurs here in a quartz vein from 1 to 3 feet wide. Mr. W. L. Haley, of Hackberry, who has been developing the property, reports that a number of tons of tungsten ore averaging 65 to 75 per cent were mined; but none has been shipped.

Development work was continued on the tungsten deposits that are located in the foothills of the west slopes of the Snake Mountains, near the base of Wheeler Peak, about 12 miles south of Osceola, White Pine County, Nev., and rich tungsten ores have been shown to exist there. Practically the only drawback to these deposits is their distance from railroad transportation.

In Colorado, tungsten ores (wolframite and hübnerite) have been found in quantity in San Juan, Boulder, Gilpin, Ouray, and Lake counties. During the last year the principal mines that have been worked are those in Boulder County. The Great Western Exploration and Reduction Company, of Boulder, has recently been organized, not only to mine tungsten ores, but also to reduce the ore and manufacture a ferro-tungsten alloy. These ores will concentrate from 20 tons into 1 to 3 tons into 1, and the concentrates will average from 60 to 68 per cent of tungstic acid. The larger proportion of these concentrates have been sent East, where they have been manufactured into the ferro-tungsten alloy. In San Juan County, a small amount of tungsten ore was mined, which concentrated 7 tons into 1.

In the Cliff mine, in the Virtue district, a few miles east of Baker City, Baker County, Oreg., there is a deposit of massive scheelite which carries considerable free gold. It is reported that at water level the vein material consists almost entirely of scheelite.

There has been a little mining at the tungsten mines in South Dakota, the principal ones being the Harrison and the Durango mines, two adjoining mines in the North Lead mining district, near Lead, Lawrence County.

The scheelite mines of the American Tungsten Milling and Mining Company, located near Long Hill, Fairfield County, Conn., have been worked very little during the last year. An elaborate description of the occurrence of this ore has been published by Prof. William Herbert Hobbs, in the Twenty-second Annual Report of the United States Geological Survey, Part II, 1902. According to Professor Hobbs, there occur at this locality beds of diorite and hornblende-gneiss, with intercalary beds of crystalline limestone, forming a nearly horizontal, waving monocline or gentle syncline. The contacts show essentially conformable bedding, the gneissic marginal planes of the gneiss being practically parallel to the well-marked bedding planes in the limestone.

The tungsten minerals, scheelite and wolframite, are generally more abundant at the lower contact. Near the summit of the hill in the main opening of the mines, where a fresh contact zone was encountered, the material was found to be a massive quartz-zoisite-epidote-hornblende rock, which contained, irregularly disseminated through it, small particles and crystals of scheelite, and these are often concentrated in crystalline masses, sometimes as large as the fist. The proportion of scheelite in the vein is approximately 5 per cent, as was determined from actual mill tests.

USES.

The uses of tungsten are varied. Until recent years about the only uses were in the preparation of salts for making colored cotton goods "fast," or washable, and in rendering clothes for theatrical and other purposes noninflammable. It has also been used to a certain extent in the manufacture of stained paper. Now the chief use of tungsten, either in the form of the alloy, ferro-tungsten, or as the powdered metal, is in the manufacture of tungsten steel. Alloys are also made of tungsten with aluminum and copper, the latter being used in the manufacture of propeller blades. Calcium-tungstate, one of the salts of tungsten, is used in Röentgen ray apparatus, on account of its fluorescence. Another use is for coloring glass.

TESTS FOR TUNGSTEN.

When the mineral to be tested is readily decomposed by boiling with hydrochloric acid, an insoluble canary-yellow tungstic oxide, WO_3, will be obtained if the mineral contains tungsten. If a little granulated tin is added to the solution and the boiling is continued, a blue color is obtained, which finally changes to brown by further boiling. If, however, the tungsten mineral is insoluble or not easily soluble in boiling hydrochloric acid, as in the case of the mineral wolframite, the finely powdered mineral should be mixed with six times its volume of sodium carbonate, and the mixture be made into a paste with water and fused. By pulverizing the fused mass the sodium tungstate formed during the fusion is readily dissolved in a test tube with a little water. By acidifying this filtrate with hydrochloric acid and boiling with tin the blue color is obtained.

PRODUCTION.

The production of tungsten ores during 1901 amounted to 179 tons, which were concentrated from 1,221 short tons of the crude ore. The concentrates varied from 60 to 70 per cent of tungstic oxide, and were valued at $27,720, which is an average of $154.86 per ton. The highest recorded price received for tungsten concentrates was $333 per ton, and the lowest $102. The general market price, however, was between $102 and $200 per ton, according to percentage of tungstic acid. The larger part of the tungsten produced in the United States was from Boulder County, Colo., with smaller amounts from San Juan County, Colo., from near Lead City, S. Dak., and from Long Hill, Conn. A considerable quantity of tungsten ore was mined at a number of other mines, but it was not concentrated nor sold—in some cases on account of its distance from the railroad, and in others on account of the prevailing low prices for the ore. At the Nevada mines, near Osceola, 1,200 tons of ore were taken out and are now lying on the dumps. At the rich mines in the Dragoon Mountains, Arizona, only the necessary assessment work was done. In the Arivaca district in Arizona, however, plans are forming for the erection of a mill for treating the tungsten ores that occur there. Of the crude ore, 2,918 short tons were recorded as having been mined in 1901.

As the amount of tungsten used in the arts is limited, there can readily be an overproduction, and the low price prevailing for the ore is partially due to its having been forced on the market in greater quantity than was demanded. The price increases with the percentage of tungstic oxide, and also according to its freedom from sulphur and phosphorus. The scheelite ore brings the higher price, as it is more easily treated than iron or manganese tungsten ores.

The price of tungsten ores has decreased from 50 to 75 per cent during the last two years. An ore averaging from 45 to 55 per cent of tungstic acid will bring about $2 per unit, and ores running from 65 to 75 per cent will bring from $2.50 to $3 per unit, if they are free from phosphorus and sulphur.

MOLYBDENUM.

A few years ago there was but little demand for molybdenum minerals, except for their limited use in the manufacture of certain chemical reagents, but there is now a very noticeable increase in the market for these ores. The chief sources of this metal are the minerals molybdenite, MoS_2, and, much less abundantly, wulfenite, $PbMoO_4$.

Molybdenite is usually found in foliated masses or in scales, with a perfect basal cleavage and a metallic luster. When crystallized it is in short, tabular, hexagonal prisms. It is very soft, 1 to 1.5 in the scale of hardness, being readily scratched with the finger nail, and is of a pure lead-gray color. It is often mistaken for graphite (plumbago), which it sometimes very closely resembles; but it can be distinguished from graphite by its color, which is of a more bluish gray; by its streak on paper, which is gray to bluish gray—graphite is black—and by its behavior before the blowpipe, molybdenite giving off sulphur dioxide, which can readily be detected by its odor, graphite remaining unchanged when heated. Wulfenite is commonly found in square, tetragonal crystals, that are sometimes very thin; it is also found granulated and massive. It has a resinous to adamantine luster, and ordinarily an orange yellow to bright red color. It is usually found in veins with lead minerals.

OCCURRENCE.

Molybdenite generally occurs in beds, or is disseminated through crystalline rocks, principally granite, gneiss, syenite, and granular limestone; and it has been found sparingly in these rocks at many localities. It is found abundantly in the Western States, and a great amount of prospecting for it has been carried on. A number of new localities have been opened up during the last year, and some give promise of containing this mineral in quantity.

California.—In Mono County a very promising molybdenite deposit has been developed 12 miles northwest of Bridgeport, on the west fork of the Walker River, by Mr. Robert A. Cameron and Mr. S. B. Fales, but it is now owned by Mr. Frank H. Saxton, of Carson City, Nev. As described by Mr. Saxton, there is a large ledge of white vitreous quartz, several hundred feet in width, which can be traced by a series of outcrops for a distance of nearly 3 miles. Where the development has been made there is an outcrop of this quartz 700 feet long by

300 feet wide. The molybdenite seems to be somewhat erratic in its occurrence, but it is always near the center of the wide vein of quartz, which is much more brittle where it contains the molybdenite than elsewhere. Sometimes the mineral is disseminated in particles through the quartz; at other times it is in concentric rings of small seams of molybdenite, and in seams of quartz up to 18 inches in thickness. This molybdenite-bearing core is about 20 feet in diameter. The molybdenite also occurs in pockets, containing as high as 20 pounds of molybdenite (MoS_2) and molybdite (MoO_3), the yellow oxide. Some pyrite was also found associated with the molybdenite. Although the work done has shown that there is a large quantity of molybdenite in the deposit, it has not demonstrated whether the molybdenite is concentrated sufficiently to make a profitable ore. It is also reported that on Alamo Mountain, in the northeastern part of Ventura County, a rich deposit of molybdenite has been found on property owned by Mr. Donald McDonald. The vein is said to be from 8 to 15 feet in width. In Los Angeles County a prospect is being developed by Mr. James B. Cook, of Los Angeles, Cal.

Washington.—Deposits of molybdenite are being worked by the Crown Point Mining Company, of Seattle, Wash., on Railroad Creek, in the Stehekin mining district, about 18 miles west of Lake Chelan, in the western part of Chelan County. The development work carried out by this company consists of about 110 feet of open cuts, and of two tunnels, one of which has been driven a distance of 195 feet westerly into the mountain, and the other has been driven 80 feet in a southwesterly direction. The molybdenite is associated with gold, silver, and copper ores, and, from what can be learned regarding its occurrence, it can be obtained in quantity.

Montana.—At the Leslie copper mine, in the western part of Missoula County, Mont., considerable molybdenite was encountered in the upper parts of the mine. The property is being worked for gold and copper principally, but, according to reports received from Mr. Wesly Everett, of Wallace, Idaho, president of the Leslie Copper Mining Company, considerable molybdenite was encountered in a 150-foot drift which was run on a vein, and he states that they could obtain this mineral in quantity.

Utah.—Molybdenite has been discovered near Leamington, Millard County, by Messrs. W. G. Palmer and Brigham Clark, who have located claims covering these deposits. Not sufficient development work has yet been done to determine the exact extent of the deposits or of the percentage of molybdenum, but a sample of the ore sent shows it to be of good quality. The molybdenite occurs as small particles disseminated through quartz, and in places in small seams of almost pure molybdenite.

Arizona.—In the Santa Rita Mountain district, Pima County, a vein of molybdenite 5 feet wide and carrying 15 per cent of this mineral is reported to have been found, but no definite information can be obtained regarding the correctness of this report.

New Mexico.—About 25 miles from East Las Vegas, San Miguel County, molybdenite occurs in considerable quantity. The property is owned mainly by Arthur N. Jordan, of East Las Vegas, but up to the present time nothing but assessment work has been done, on account of the uncertainty as to the actual value of the mineral. It is expected, however, that these deposits will be thoroughly developed during the coming year.

Molybdenite has also been reported to occur in quantity near Portage, Aitkin County, Minn., and near Cripple Creek, Colo., but thus far no definite information has been obtained regarding the exact location of these deposits, nor as to whether the mineral does occur in quantity.

Alaska.—In the vicinity of Skagway, Alaska, a molybdenite deposit has been developed to a limited extent by Mr. J. R. Rollins, of Skagway, who writes that the deposit consists of white quartz that contains "kidneys" of molybdenite scattered through it, varying from the size of a man's head down to that of a pea. Sufficient work has not been done to determine definitely the value of the claim, but the indications are good.

USES.

For a number of years the principal use of molybdenum has been in the manufacture of certain chemical reagents, especially of ammonium molybdate, which is used in the determination of phosphoric acid. It is also used in the preparation of "blue carmine" for the coloring of porcelain. During the last few years it has been discovered that molybdenum gives very beneficial properties to steel, and a ferro-alloy of this metal is now being made to be used in the preparation of a special steel. It is often supposed that molybdenum is used at times in the place of tungsten in the manufacture of hard steels; but each has certain valuable properties that it gives to steel, which the steel manufacturers are rapidly beginning to appreciate, and the evidence of this is in the increased demand for this metal during the last year by the manufacturers of ferro-molybdenum. Molybdenum is sold as the metal, and also as a nickel-molybdenum alloy.

TEST FOR MOLYBDENITE.

A good test for the sulphide of molybdenum is to heat a fragment of the mineral on the flat surface of a piece of charcoal for a considerable time in an oxidizing flame. There is then deposited a short distance from the assay a coating of molybdic oxide, MoO_3. This is pale yellow when hot and almost white when cool. This oxide is volatile in the oxidizing flame, but if touched for an instant with a moderately hot reducing flame it assumes a beautiful ultramarine-blue color.

PRODUCTION.

The production of molybdenite in the United States during the year 1901 has probably not been over 10 to 15 tons. This does not begin to represent, however, the amount that is demanded by the market. The actual value of these molybdic ores is not easily determined, as the quotations vary widely from 10 to 15 cents up to $1.10 per pound. The ore, to be marketable, must contain over 45 per cent of molybdenum, and be free from copper. The average price of a 50 to 55 per cent ore is probably about $400 a ton.

Considering the demand for this mineral, there should be a large increase in the production of 1902 over that of 1901. As in the case of tungsten, the amount of molybdenum used is limited, and the market could readily be oversupplied, when at once the price would be very materially reduced.

URANIUM AND VANADIUM.

During the last few years there has been some demand for these metals for experimental work as to the beneficial properties which they impart to steel. Thus far, however, no practical results have been obtained, although it has been shown that both ferro-uranium and ferro-vanadium alloys, when added in small amounts to steel, do give beneficial results. Experiments are still being made along this line. This demand for these metals has stimulated prospecting for them, so that now the minerals containing them are found in considerable quantity, whereas formerly their occurrence was supposed to be rare.

OCCURRENCE.

The minerals that are the source of uranium and which are known at the present time are uraninite, gummite (an alteration product of uraninite), and carnotite. The last mineral contains also a considerable percentage of vanadium.

The principal occurrences of uraninite are at the Wood, the Black Hawk, and the Kirk mines near Central City, Gilpin County, and on Dolores River, at the mouth of Disappointment Creek, 80 miles west of Dolores, Montezuma County, Colo. It has also been found on the eastern slopes of Paradox Valley, in Montrose County, Colo. In South Dakota it has been found in the Ross Hannibal mine, in the Ruby basin of the Black Hills, but thus far it has not been definitely determined whether there is sufficient quantity to mine. Various uranium minerals have been reported as occurring sparingly in many of the pegmatitic dikes and metalliferous veins of Montana and California. It has also been found to some extent in the President mine, near Elizabethtown, Colfax County, N. Mex. In some of the pegmatitic dikes of Mitchell County, N. C., uraninite and gummite have been found in some quantity, but no particular work has been done for these minerals except as by-products in mica mining.

The mineral carnotite, which was described in detail in the reports for 1899 and 1900, occurs at La Salle Creek, southwest of Paradox, Montrose County, Colo., about 6 miles up the creek from Cashin. This mineral contains from 47 to 54 per cent of uranium oxide (UO_3) and from 15 to 18 per cent of vanadium oxide (V_2O_5). It is reported that a similar uranium and vanadium mineral has been found on the western slopes of the La Salle Mountains, in southeastern Utah, but on account of the distance to the nearest railroad station, which at the present time is Placerville, 100 miles away, no investigation has been made to determine the extent of the deposits.

The principal mineral that is the source of vanadium, besides the carnotite just mentioned, is vanadinite, a lead vanadate, $(PbCl)Pb_4(VO_4)_3$. This mineral has been found in some quantity in the gold and silver mining districts of Arizona and New Mexico, especially at the Vulture and the Phœnix mines, in Maricopa County, and at the Mammoth mine, near Oracle, Pinal County, Ariz. In New Mexico it has been found at Lake Valley, Sierra County, and at the Mimbres mines, near Georgetown, Grant County, At the carnotite locality in Colorado a green micaceous mineral has been found which acts as a cementing bond to a sandstone, and constitutes about 20 per cent of the rock. Upon analysis this green mineral was found to contain 13 per cent of vanadium oxide (V_2O_3), which would make the amount of this oxide in the sandstone about 3.5 per cent.

Vanadium has until recently been obtained from certain slags at Creusot, France. It has also been found in the ash of certain coals, and this source of vanadium is beginning to attract the interest of manufacturers and chemists.

USES.

Both uranium and vanadium are used to a limited extent in the manufacture of the ferro-alloys of these metals. These alloys increase the tensile strength and toughness of the steel to a remarkable degree. As far as can be learned, no commercial steel has thus far been made that contains the uranium or vanadium alloy, and it still remains a product of the laboratory. Other uses of uranium compounds are in the manufacture of porcelain and glass, the oxides producing a pure black glaze on porcelain. A hydrated sodium uraninate and a hydrated ammonium uraninate are used for the decoration of glass and china ware, as they give permanent yellow colors.

Vanadium compounds are used in the manufacture of vanadium bronze, a fine yellow pigment that is used in the place of gold bronze. The use of vanadium oxide in dyeing, which has been so extensive, is reported to be declining on account of the introduction of other substances which cost less and produce a black equally good.

In a recent article by Dr. J. Ohly on "The commercial preparation of vanadium and uranium compounds from carnotite,"[a] he describes a process by which the mineral carnotite can be advantageously treated, with the view, first, to eliminate the vanadium contents in the form of sodium vanadate, or the oxide, and, secondly, to recover the uranium remaining in the residue as a uraninate, or the oxide. As stated by Dr. Ohly, the results obtained by this process are satisfactory, and a plan has been devised by the Mines and Smelter Supply Company, of Denver, Colo., to treat these carnotite ores according to Dr. Ohly's process.

PRODUCTION.

The production of the minerals containing uranium and vanadium has been confined for the most part to Colorado, and during 1901 amounted to about 375 short tons of the crude ore. This production included carnotite, containing both uranium and vanadium, uraninite (pitch blende), and vanadinite, but the exact proportion of each could not be ascertained. The larger amount has, however, been the mineral carnotite.

In Montrose County the main producer was the Copper Prince Mines and Mill Company, of Paradox, and in San Miguel County, the Poulot and Voilleque companies, of Cashin.

A part of this ore is sold in the crude state; some is sold after concentration; and still another part is subjected to a crude chemical treatment, in which there is a partial separation of the uranium oxide. Most of the uranium and vanadium compounds that are produced are exported, as well as some of the concentrated ore.

The value of the crude ore is hard to estimate on account of the variation in its percentages of uranium and vanadium. The highest recorded price received for this crude ore was $150 per ton. The production of uranium oxide has been sold as high as $1.20 per pound. The prices of these ores are bound to fluctuate on account of the uncertain demand for them and of their uncertain production.

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[a] Mining and Metallurgy, October 1, 1901, page 562.

TITANIUM ORES.

By W. O. SNELLING.

INTRODUCTION.

The recent discovery of large deposits of rutile in Virginia has brought to the attention of the ceramic and steel industries the commercial possibilities of this ore of titanium, which, owing to the small supply that has hitherto been available and to the impure state in which it is generally found, has been but little used in this country, the few hundred pounds produced annually going largely to collectors of minerals and to the manufacturers of artificial teeth, who use the pure oxide as a pigment in reproducing in porcelain the natural yellow color of the tooth.

Up to the present time, notwithstanding the clearly recognized value of titanium as a component of a "special" steel, and notwithstanding the use of the oxide for many years past by foreign potters, it is doubtful if more than a very small quantity of titanium has been used in the United States for either of these purposes. Although titanic pig iron has been and is produced by several furnaces, it represents the results of working highly titaniferous iron ores for the iron they contain, rather than any attempt to produce a definite titanium alloy; and the titanium is present in the pig in very small quantity, nearly always less than one-half of 1 per cent.

OCCURRENCE.

Minerals containing titanium are found widely distributed and in such large quantities as to make titanium a relatively abundant element.

The idea so generally held of the comparative rarity of titanium in nature is quite erroneous, as has been shown by Dr. F. W. Clarke's researches on the relative abundance of the chemical elements.[a] Basing his conclusions upon a great number of analyses, Dr. Clarke has shown that titanium is relatively more abundant in the known portion of the solid crust of the earth than manganese, carbon, or sulphur.

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[a] Bull. U. S. Geol. Survey No. 78; also No. 168.

Nearly all the text-books on chemistry speak of titanium as one of the very rare metals, and class it with cerium or even thorium, although it is found in nature in greater quantity than all of the thirty rarer elements taken together.

In some places, particularly in the Adirondacks, and to a lesser extent in many other parts of the earth, titaniferous iron ores are found in enormous quantities, making one of the principal components of great rock masses so extensive as to form mountains and to constitute a geological formation, and small quantities of titanium are found in nearly all of the older rocks, although not often looked for nor recognized in ordinary rock analysis.[a]

The most abundant of all the titanium minerals is ilmenite (ferrous titanate—$FeTiO_3$), which, combined with varying quantities of ferric oxide, is found concentrated in beds of great extent, particularly at Kragerö, in Norway, Bay St. Paul, in Canada, and in Rhode Island, Connecticut, New York, North Carolina, Pennsylvania, and Vermont, in the United States.

Ilmenite is generally found massive, and less often in irregular grains, both forms showing submetallic luster, iron-black color, specific gravity of 4.7 to 5.1, and hardness varying from 5.5 to 6. When a crystalline structure is apparent its form is a rhombohedron of the hexagonal system.

Rutile (titanium oxide—TiO_2) is generally found wherever large deposits of ilmenite occur, and besides the localities mentioned for ilmenite, it is found in notable quantities at Graves Mountain, Georgia, Magnet Cove, Arkansas, and in Nelson County, Va.

Rutile usually occurs in tetragonal prismatic crystals, yellow, brown, or red in color, specific gravity 4.2, adamantine luster, and hardness varying from 6 to 6.5.

Both ferric oxide and titanium oxide unite with ferrous titanate (ilmenite) in all proportions, forming a series of compounds varying continuously in composition between the limits TiO_2 and Fe_2O_3. Thus we have light-yellow rutile, consisting of practically pure titanium oxide; darker colored rutile, containing a small quantity of $FeTiO_3$; then black rutile (nigrine), containing a relatively greater proportion of $FeTiO_3$, and so on, until the ferrous titanate becomes the principal constituent and the proportion of TiO_2 becomes less and less. But the series is extended still further, for the $FeTiO_3$, combining with Fe_2O_3, produces compounds in which the ratio between the Ti_2 and Fe_2 becomes fractional, and which contain a greater quantity of Fe_2O_3 than $FeTiO_3$; and this continues until we have Fe_2O_3, containing a very small quantity of ferrous titanate, the compound now representing a slightly titaniferous hematite.

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[a] When TiO_2 is not separated, it is reported with the Al_2O_3.

These intermediate compounds, now collectively called titanic iron, were formerly included under the single mineralogical name menaccanite, and subspecies were recognized, in which the percentage of Ti_2 lay between certain arbitrarily set limits. In this way the names nigrine, ilmenorutile, kibdelophane, crichtonite, hystatite, uddevallite, basanomelan, etc., were given; but as the composition of these bodies was not definite, they did not represent true minerals, but, as has been shown, mineral mixtures.

Among the many other titanium minerals might be mentioned: Perovskite ($CaTiO_3$), pyrophanite ($MnTiO_3$), geikielite ($MgTiO_3$), pseudobrookite [$Fe_4(TiO_4)_3$], titanite or sphene ($CaTiSiO_5$), brookite (TiO_2), and octahedrite or anatase (TiO_2), and the more complex minerals containing titanium, neptunite, derbylite, dysanalyte, warwickite, polymignite, mauzeliite, lewisite, schorlomite or melanite, tscheffkinite, rinkite, mosandrite, guarinite, keilhauite, zirkelite, pyrochlore, æschynite, polycrase, euxenite, astrophyllite, johnstrupite, etc.

USES.

In ceramics.—In the pottery industry the manufacturer is constantly seeking novel effects, and, although the many beautiful wares now on the market show clearly his success, yet it will be noted that in every case it is in form or design, and not in color, that his most pronounced results have been achieved. This has not been due to lack of enterprise or of chemical knowledge, but to the fact that the choice of colors which may be used in porcelain decoration, upon the biscuit or under the glaze, is extremely limited, for the great heat of the potter's furnace destroys all organic colors, and there are but few mineral colors which do not break up at the temperature which must be maintained in the process of firing. The list of colors for painting upon porcelain after firing is now very large, and gives every variation of color and shade that could be desired. But even the very best effects which can be produced by muffle colors fall far short, in depth and richness, of the decoration executed under the glaze, for during the firing the glaze and the pigments fuse together, producing a softness of color effect totally lacking in the work of muffle colors.

Under-glaze painting has, besides, the great advantage of being protected in a considerable measure from the many accidents to which painting upon the glaze is liable; and as it is a part of the ware itself, rather than a simple layer upon it, it does not crack, nor peel off, nor present the rough slightly raised surface so characteristic of muffle colors.

Under these circumstances it is not surprising that some of the leading potters, both in the United States and abroad, have adopted mono-chromatic styles of decoration, preferring one color under the glaze to the entire spectrum in surface work, and the success of those carrying out this idea has been notable from both an artistic and a financial point of view.

The many advantages of under-glaze or body work are, however, lessened by the fact that so few pigments are available for this use, and hence it is highly advisable to utilize to the fullest possible extent all of the materials which can produce satisfactory results, even if many minor disadvantages attend the use of some of them, as is undoubtedly the case.

The principal substances which can be used for under-glaze work are the oxides of cobalt, copper, chromium, iron, iridium, titanium, and uranium, and alkali and alkali earth chromates and uranates also are sometimes employed. Of these, both the compounds of uranium and the oxides of iron and titanium produce a yellow color in porcelain. Uranium is a rare metal, and its compounds are expensive; therefore its use is naturally restricted to the higher-priced wares. Of course no such objection can be raised against the oxide of iron, but it has not proved entirely satisfactory, and the yellow produced by it admits of little variation in tone or shade.

Under favorable conditions titanium oxide imparts to porcelain a fine yellow color. It is capable of being used with other substances to produce secondary colors, and it will withstand without difficulty the heat of the kiln, although at very high temperatures it increases the fusibility of the porcelain somewhat, acting as a flux.

The ware containing titanium oxide must, however, be entirely shielded from the action of the gases resulting from combustion, and it has been neglect of this most important precaution that has resulted in the failures to obtain satisfactory results from this pigment. In the manufacture of artificial teeth, where titanium oxide forms the pigment universally used (and with perfect success), the walls of the muffle are coated with clay before each firing, thus effectually preventing reducing gases from injuring the ware.

When TiO_2 is reduced by carbon monoxide, the lower oxide Ti_2O_3 may be produced. This is a copper-red compound, and corresponds in color to the effect produced when paste containing titanium is fired in presence of reducing gases.

Many other compounds of titanium might possibly be formed at high temperatures in the presence of CO and atmospheric nitrogen—the more probable compounds being the nitrides Ti_3N_4 and Ti_2N_2, and perhaps the carbonitride $Ti(CN)_2.3Ti_3N_2$—and varying quantities of these would explain the blue color which is sometimes produced, but both this color and the reddish effect before mentioned are avoided if reducing gases are not present.

It might be questioned if, in view of the difficulties presented, the use of titanium oxide could be made commercially successful, and this question is deserving of careful consideration. In the first place, the fusible properties of the paste might be corrected by diminishing slightly the usual quantity of feldspar, and thus this fault could be quickly eliminated. But to prevent the access of furnace gases is much harder. The only way to accomplish this which seems at all practicable is to have the saggers gastight, even though luting might be necessary to effect this: and whether this would be practicable depends upon how much care can profitably be expended upon the ware. It must be admitted that in general the use of TiO_2 is not likely to be very successful, although for particular cases, when the results sought justify a great amount of work in the preparation of the finished goods, a good field is opened for trials of this pigment.

The composition of the body used for artificial teeth is kaolin, feldspar, and silica, in approximately the proportion, by weight: kaolin 6 per cent, silica 19 per cent, and feldspar 75 per cent; and although this composition varies widely from the proportions of these substances as used in pottery, the difference is not essential and would produce no alteration in the effect with TiO_2, which is mixed with the paste in quantity varying with the color wanted, from one-half of 1 per cent to several per cent.

The production of artificial teeth in the United States has been estimated to reach 8,000,000 annually, and in all of these titanium oxide is the pigment employed. This shows the degree of success which has attended its use in the dental industry.

In steel.—As a result of the great amount of attention which has been devoted during the last two decades to the changes in the properties of iron produced by the admixture of small quantities of other elements, a number of "special" steels have been produced, some of which have been commercially developed with great success, while others are still in their experimental stages.

The causes which have led to so much work being done in the preparation of these steels are not hard to find when we see how great a variation there is between the properties of some of them; so that where one possesses an exceptionally great tensile strength, admirably fitting it for some uses, another will have a remarkably high limit of elasticity or a considerable degree of malleability or some other property which will adapt it for some other particular use. In the manufacture of machinery there is a demand for just such materials, one kind of steel being used for the shafts, another for cutting edges, a third for some other part; and the steel for each of these purposes is required to be the best for its particular use.

It will be seen, then, that there is a special field for nickel steel, chromium steel, etc., and that the commercial preparation of these steels, as well as of manganese, tungsten, silicon, and molybdenum steels, does not in the least alter the value of titanium steel, which experimental work, so far as completed, seems to show has some important properties. Of these the most marked are a high limit of elasticity and a greater elongation as well as an increased ductility over simple carbon steel; and as titanium steel takes a good temper and is very hard, a number of possible uses suggest themselves, dependent only upon the economical preparation of some titanium alloy.

At the temperature of the blast furnace TiO_2 is not reduced, at least not permanently, although it is possible that reduction and subsequent oxidation occur, so that the use of the oxide as a medium for introducing titanium into iron or steel is not possible. Ilmenite, besides being extremely refractory, is converted when reduced in the furnace to Fe_2CO and titanium carbonitride, $Ti(CN)_2 3Ti_3N_2$, and as the latter compound is insoluble in melted iron and irreducible at the temperature employed in smelting, it separates from the iron, so that the pig contains little or no titanium, even though the ore held 10 per cent or more.

It becomes necessary, then, to produce some alloy of titanium as a means of introducing the metal into fused iron, and so far two methods have been tried for effecting this object, both depending upon the reducing action of aluminum and the consequent preparation of metallic titanium from its oxygen compounds.

The first of these two methods consists in mixing aluminum and rutile, both in a state of fine powder, and heating the mass until the aluminum, in virtue of its greater affinity for oxygen, forms alumina, the titanium oxide being reduced to metallic titanium as represented by the equation: $4Al_2+6TiO_2=4Al_2O_3+3Ti_2$. The method in this case is quite the same as that now used in the preparation of so many of the rarer metals from their oxides, but the cost of the aluminum is almost prohibitive of such use, since it is much greater for the powdered material than for aluminum in ingots. Hence, titanium alloys produced in this way cost about $1 per pound, and to use such an alloy, say to the extent of 10 per cent, would produce a steel too costly for practical use.

The second method of preparing a ferrotitanium alloy is by the reducing action of a bath of melted aluminum in the electric furnace. While the consumption of aluminum per pound of titanium produced is still as great as before, yet the substitution of the ingot metal for the higher priced powder makes this method much cheaper, so that a ferro alloy can be produced for about 20 cents a pound.

This application of the heat of the electric furnace together with the action of a reducing bath of aluminum has been developed by Mr. A. J. Rossi, who uses ilmenite, however, instead of rutile as the raw material. As the iron oxide of the ilmenite, as well as the titanium oxide, must be reduced, a large quantity of the aluminum is wasted in deoxidizing Fe_2O_3, which can be much more economically reduced in other ways; but the substitution of rutile at a low price for ilmenite should effect a considerable saving in the cost of working this process.

PRODUCTION OF RUTILE.

Until the opening of the rutile deposits of Virginia, Norway was the principal producer of this article, and for the years 1893–1901 the amount and value of the product in the United States and Norway was as follows:[a]

Production of rutile in the United States and Norway from 1893 to 1901, inclusive.

Year.	United States.		Norway.[a]	
	Quantity.	Value.	Quantity.	Value.
	Pounds.		*Pounds.*	
1893	....	....	15,432	$1,620
1894	150	$450	41,887	4,050
1895	100	350	61,729	8,100
1896	100	350	66,138	9,720
1897	100	350	70,547	5,400
1898	140	700	77,161	5,940
1899	230	1,030	91,854	6,750
1900	300	1,300	57,485	5,643
1901	[b] 250 44,000	[b] 1,310 4,400	....	....

[a] 1893–1898 from Mineral Industry; 1899–1900 from Tabeller vedkommende Norges Handel.

[b] Estimated. It is to be noted, however, that the product of the United States, up to the year 1901, has been very different from that of Norway, and consisted of selected specimens worth about $3 per pound as compared with the ordinary Norway rutile worth about 10 cents a pound. The Virginia product is of the same grade as the Norway product.

The production of the Virginia deposits commenced in 1900, and to the close of 1901 the output has been about 40,000 pounds, while the production of the other rutile properties in the United States during the last year is insignificant and will not possibly exceed 4,000 pounds.

Prof. George P. Merrill, in a paper read before the Geological Society of Washington, D. C., in describing the geological features of the Virginia rutile beds, said:

> The deposit lies on both sides of the Tye River, near Roseland post-office, in Nelson County, Va. The country rock is a strongly foliated gneiss, traversed occasionally by dikes of hypersthene diabase. The rutile occurs associated with a coarsely crystalline quartz-feldspar rock, the exact nature of which has not been made out, but which, from the size of the deposit and its crystalline nature, is judged to be eruptive. The full extent of the deposit has not yet been determined, but must comprise several hundred acres on both sides of the Tye River.
>
> The ore occurs mainly in the form of small granules of all sizes up to 2 or 3 millimeters in diameter, which are sometimes disseminated with wonderful uniformity throughout the feldspathic ground mass or again segregated in the quartz.
>
> The petrographic character of the rock is very interesting. The most common type, as already stated, is a coarsely crystalline aggregate of potash and soda-lime feldspars of a very light gray, almost white, color, throughout which are disseminated the small rutiles like the phenocrysts of quartz in the Chalk Mountain, Colorado,

Nevadite, as described by Dr. Whitman Cross. With this is associated a peculiar bluish opalescent quartz which, however, occurs under such conditions as to suggest that it is not a result of primary crystallization. Occasionally, as at the opening at present being worked, the quartz predominated over all other constituents, and masses of several tons weight are procured in which the rutile granules occur in quantities up to 25 per cent of the entire mass. The rock is remarkably free from other minerals than those mentioned, with the exception of microscopic inclosures of sericite resulting from the feldspathic alteration. There is a complete absence of titaniferous iron or other heavy minerals such as would render difficult a separation of the rutile by ordinary gravimetric methods.

A sufficient amount of exploitation has not yet been made to enable the character of the contacts or the exact boundaries of the deposit to be made out. In a general way they can be ascertained by the color of the decomposition products, the country rock yielding a deep red clay, while the feldspathic gangue from the rutile deposit breaks down into a light grayish, more sandy, material.

Frequent prospect holes have been opened, and it is safe to say that enough ore is in sight to supply any demand likely to arise for a long period. Abundant water supply is furnished by the Tye River, and should the demand for the material continue to increase there is every reason to look for the development of quite an important industry along lines heretofore untouched.

The Virginia rutile is of excellent quality, being very pure, and the supply is practically unlimited, but no market has been found for it yet, none having been sold in the United States and the small foreign demand being filled at such low prices by rutile from Norway that exportation could hardly be called profitable.

Up to the present time the demand for rutile in the United States has been limited to the few hundred pounds annually used in the artificial-tooth industry, and this is satisfactorily supplied by the Chester County, Pa., deposits.

If rutile should be used with success by American potters it would afford a more extended market, but the demand would not be likely to exceed a few tons annually. The importance of a substance should not, however, be measured by the amount which is consumed, but rather by the results which arise from its application in the arts.

The use of titanium in steel might open a much wider market for rutile, but at present ilmenite is exclusively used as a source of titanium for steel, and late developments in the preparation of ferro-titanium alloys have all been toward the use of ilmenite, the abundance and cheapness of which particularly fit it for such use.

Under favorable conditions a market for American rutile will undoubtedly develop, but it is doubtful if the demand, for the uses now known, will be very great. In Norway, with a practically unlimited supply of a very pure product, the extent of the industry averages annually about 30 tons, worth about $6,000, and this represents practically the entire amount of rutile used in Europe.

COAL.

By Edward W. Parker.

INTRODUCTION.

The statistics presented in the following tables, which deal primarily with the production of coal in the United States in 1901, have been made as nearly uniform as possible with the preceding reports of this series. In some cases it has been found feasible to eliminate details regarding the statistics of production in preceding years. These are recorded, however, in full in the earlier volumes, to which readers are referred.

In 1901 the United States not only exceeded all previous records in the production of coal, but strengthened, and practically made permanent, the position of this country as first among the coal-producing nations of the world. Two years before, in 1899, the United States exceeded the production of Great Britain, our only strong competitor, by a little over 7,000,000 short tons. In 1900 this lead over Great Britain was more than doubled, and amounted to 17,479,771 short tons. In 1901, owing to the unsatisfactory trade conditions in Great Britain, the production of that country decreased 6,134,355 long tons, or 6,870,478 short tons, while the production in the United States increased 23,615,689 short tons, and exceeded the product of Great Britain by 47,965,938 short tons. Moreover, the production of the United States in 1901 exceeded the combined production of Great Britain and all her colonies, the combined output of which was approximately 267,750,000 short tons, an amount exceeded by the United States production last year by over 25,500,000 short tons.

The period for which there are any reliable statistics regarding the coal production of the United States dates from 1868. In that year the United States was third among the coal-producing countries of the world, being preceded by both Great Britain and Germany, and contributed less than 15 per cent of the total world's supply. Germany was relegated to third place in 1872, although it exceeded our production once or twice subsequent to that date. The steps by which the United States has grown to the front rank among the industrial countries is shown in a subsequent table of the world's production. This country contributed in 1901 practically one-third of the world's total.

The history of the coal-mining industry in 1901 was satisfactory in more than one respect. It was comparatively little disturbed by labor troubles, the strikes which did occur being generally of a local nature and of short duration. The prices were well maintained, and in the case of anthracite coal sharply advanced. The average price for bituminous coal in 1901 was the same as in 1900. The average price of marketable sizes of anthracite advanced from $1.85 to $2.05 per long ton. The export trade in anthracite coal continues to increase, but bituminous exports fell off in 1901 and the total remains comparatively insignificant considered with the total production. The exports amounted to less than 4 per cent of the total product.

The tables of production in the United States, as presented in this report, have been compiled from direct returns from the mine operators to the Survey or its agents, with a few exceptions. In cases where operators have failed to report their production to the Survey, this office has obtained the information either from State mine inspectors or other reliable sources. In a very few instances it has been necessary to estimate the production where no direct information of any kind could be obtained. In such cases the estimate has been based upon the record for the preceding three or four years.

The spirit of combination of interests, which has affected the industry enterprises, has to a greater or less extent also pervaded the coal-mining regions, and during the last three years many mines formerly worked as independent operations are now consolidated into a few large organizations. Among these may be mentioned the following as the most important: Monongahela River Consolidated Coal and Coke Company, Pennsylvania and Alabama; The Pittsburg Coal Company, Pittsburg, Pa.; H. C. Frick Coal Company, Pittsburg, Pa.; Fairmont Coal Company, Fairmont, W. Va.; Columbus and Hocking Coal and Iron Company, Columbus, Ohio; Kanawha and Hocking Coal Company, Columbus, Ohio; Sloss-Sheffield Steel and Iron Company, Birmingham, Ala.; Northern Fuel Company, Denver, Colo.; Central Coal and Coke Company, Kansas City, Mo.; Consolidation Coal Company, St. Louis, Mo.

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Illinois; Mr. C. J. Norwood, Chief Mine Inspector of Kentucky; Mr. Gomer Thomas, State Mine Inspector of Utah; Mr. James E. Roderick, Bureau of Mines, Harrisburg, Pa.; and Prof. William B. Clark and Mr. Edward B. Mathews, of the Maryland Geological Survey. The writer desires also to express his sincere appreciation of the cordial cooperation extended by individual mine operators and the officials of the mining companies for statements regarding their production, which have been furnished with practically uniform courtesy. The report on the statistics of the production of anthracite coal in Pennsylvania has been prepared, as for several years past, by Mr. William W. Ruley, Chief of the Bureau of Anthracite Coal Statistics, in Philadelphia, who acts in this capacity as special agent of the Geological Survey. Reviews of the coal trade in the important centers and shipping ports have been contributed by the secretaries of the boards of trade and other competent authorities. Those services are acknowledged in connection with their contributions.

UNIT OF MEASUREMENT.

As stated in the preceding reports of this series, it is necessary in the preparation of the report on coal production to make use of two units of measurement, the long and the short ton. This is to be regretted, but it is unavoidable. In the anthracite region of Pennsylvania, in Maryland, and in the bituminous districts of Pennsylvania, Virginia, and West Virginia, where the coal is shipped to the Atlantic seaboard or to the Eastern cities, the unit of measurement is uniformly that of the long ton of 2,240 pounds. In practically every other instance the short ton of 2,000 pounds is used as the unit of measurement. In the general tables of production, given in the following pages, the amounts have been reduced uniformly to the short ton of 2,000 pounds, and this unit is considered the standard for this report. The tables of production in the Pennsylvania anthracite region, showing shipments from that region and from the Cumberland and Upper Potomac region of West Virginia, are given, however, in long tons, in order to avoid confusion when comparing these statements with those published in other reports.

COAL FIELDS OF THE UNITED STATES.

The coal areas of the United States are divided into two great divisions, the anthracite and the bituminous.

Ordinarily, when anthracite-producing regions are considered, the term is restricted to the fields of eastern Pennsylvania, although a small amount of true anthracite coal has been produced for a number of years in Colorado and New Mexico. In previous years some coal which was classed as anthracite was mined and sold in New England.

Total production of each field since 1887.

[Short tons.]

	Anthracite.	Bituminous.		
		Triassic.	Appalachian.	Northern.
Area.......square miles..	500	1,070	70,807	11,300
Year.				
1887	39,548,255	30,000	55,888,088	71,461
1888	43,971,688	33,000	60,966,245	81,407
1889	45,600,487	49,633	62,972,222	67,431
1890	46,468,641	29,608	73,008,102	74,977
1891	50,665,931	37,645	77,984,563	80,307
1892	52,537,467	43,889	83,122,190	77,990
1893	54,061,121	36,878	81,207,168	45,979
1894	51,992,671	68,979	76,278,748	70,002
1895	58,066,516	82,682	90,167,596	112,322
1896	54,425,573	103,483	90,748,305	92,882
1897	52,680,756	116,950	97,128,220	223,592
1898	53,429,739	38,938	114,239,156	315,722
1899	60,514,201	28,353	129,843,906	624,708
1900	57,466,319	57,912	142,298,208	849,475
1901	67,538,536	12,000	150,501,214	1,241,241

	Bituminous—Continued.			
	Central.	Western.	Rocky Mountain, etc.	Pacific coast.
Area.......square miles..	58,000	94,076	43,610	1,050
Year.				
1887	14,478,883	10,172,634	3,646,280	854,308
1888	19,173,167	11,842,764	4,583,719	1,385,750
1889	16,240,314	10,036,356	5,048,413	1,214,757
1890	20,075,840	10,470,439	6,205,782	1,435,914
1891	20,327.323	11,023,817	7,245,707	1,201,376
1892	23,001,653	11,635,185	7,577,422	1,333,266
1893	25,502,809	11,651,296	8,468,360	1,379,163
1894	22,430,617	11,503,623	7,175,628	1,221,238
1895	23,599,469	11,749,803	7,998,594	1,340,548
1896	25,539,867	11,759,966	7,925,280	1,391,001
1897	26,414,127	13,164,059	8,854,182	1,639,779
1898	25,816,874	13,987,397	10,043,798	2,103,043
1899	33,181,247	15,320,373	11,949,463	2,277,741
1900	35,358,164	17,549,528	13,398,556	2,704,665
1901	37,450,871	19,665,985	14,090,362	2,798,307

RELATIVE IMPORTANCE OF THE VARIOUS FIELDS.

In point of production, by far the most important of the coal fields of the United States are those contained in the Appalachian Mountain system, which extends from Pennsylvania and Ohio on the north to Alabama on the south. Excluding the production of anthracite coal, the proportion contributed to the total coal production of the United States by the bituminous areas in the Appalachian region has varied between 60 and 70 per cent. If we include the anthracite production in the Appalachian system, this region will be credited with 74 per cent of the total coal production of the United States. The anthracite-producing regions, however, are clearly outside of the Appalachian chain and should be considered separate from the other fields. Next in producing importance to the bituminous areas of the Appalachian system are the coal-producing sections of Illinois, Indiana, and western Kentucky, which make up the Central coal field. This field in 1901 contributed 16 per cent to the total bituminous coal production of the United States, as compared with 16.6 per cent in 1900. The Western coal field, which embraces the areas contained in the States of Iowa, Kansas, Missouri, Arkansas, Texas, and the Indian Territory, is the largest in the point of area, having a total of over 94,000 square miles underlain by coal, but is only third in importance in point of production, with an output equal to about one-half that of the Central coal field, and less than one-eighth that of the Appalachian system. The Appalachian field, which yields over two-thirds of the total production, has an area of about seven-ninths that of the Western field, and about one-sixth greater than that of the Central field.

In the following table is presented a statement showing the total production of these different fields in 1887, 1899, 1900, and 1901. The year 1887 was the first one in which the production was separated according to fields. The table also shows the increases in production in 1901 over 1900, and in 1901 over 1887, with the percentages of each. The largest gain in tonnage is shown, of course, in the Appalachian system, over both 1900 and 1887. The production of this region in 1901 was 8,203,006 short tons, or 5.8 per cent over 1900, and 95,308,180 short tons, or 172.7 per cent over 1887.

Next in amount of increase over 1900 is the Western field, its gain being 2,116,457 short tons, or 12.1 per cent. The Central field increased 2,092,707 short tons, or 5.9 per cent. As compared with 1887 the increases of these two fields were reversed, the Central field showing the larger gain of 22,971,988 short tons, or 158.7 per cent, while the Western field has a gain of 9,472,951 short tons, or 92.3 per cent. The greatest proportion in increase of any is shown by the development in the last few years of the Northern coal field, which is contained altogether within the State of Michigan. This field, which produced only 71,461 short tons in 1887, contributed 1,241,241 short tons in 1901. The production last year was 391,766 short tons, or 46.1 per cent over 1900, and 1,169,780 short tons, or 1,636.9 per cent over 1887.

These statistics are shown in detail in the following table:

Production of the six principal bituminous coal fields in 1887, 1899, 1900, and 1901 compared.

Field.	1887.		1899.		1900.		1901.	
	Production.	Per cent of total.	Production.	Per cent of total.	Production.	Per cent of total.	Production.	Per cent of total.
	Short tons.		*Short tons.*		*Short tons.*		*Short tons.*	
Appalachian	55,193,034	63.0	129,843,906	67.2	142,298,208	67.0	150,501,214	66.7
Central	14,478,883	16.5	33,181,247	17.2	35,358,164	16.6	37,450,871	16.6
Western	10,193,034	11.6	15,320,373	8.0	17,549,528	8.3	19,665,985	8.7
Northern	71,461	.08	624,708	.32	849,475	.4	1,241,241	.5
Rocky Mountain	3,646,280	4.15	11,949,443	6.2	13,398,556	6.3	14,090,362	6.2
Pacific coast	854,308	1.0	2,277,741	1.18	2,704,665	1.27	2,798,307	1.2

Field.	Increase in 1901 over 1900.		Increase in 1901 over 1887.	
	Amount.	Per cent.	Amount.	Per cent.
	Short tons.		*Short tons.*	
Appalachian	8,203,006	5.8	95,308,180	172.7
Central	2,092,707	5.9	22,971,988	158.7
Western	2,116,457	12.1	9,472,951	92.3
Northern	391,766	46.1	1,169,780	1,636.9
Rocky Mountain	691,806	5.2	10,444,082	286.4
Pacific coast	93,642	3.4	1,943,999	227.5

PRODUCTION.

The total production of anthracite and bituminous coal in the United States in 1901 was 261,873,675 long tons, equivalent to 293,298,516 short tons, representing a total value of $348,910,469, as compared with 240,788,238 long tons, or 269,682,827 short tons, valued at $306,671,364 in 1900. The increase in 1901 over 1900 amounted to 21,085,437 long tons, or 23,615,689 short tons, with an increase in value of $42,239,105. The increase in 1900 over 1899 amounted to 14,234,674 long tons, or 15,942,835 short tons, and of $50,593,930 in value. The production in 1901 over 1899 showed an increase of over 35,000,000 long tons, and over 1898 of over 65,000,000 long tons. The output in 1901 was one-third larger than it was three years before. It was more than four times the production in 1880.

The output of anthracite coal in Pennsylvania last year amounted to 60,242,560 long tons, or 67,471,667 short tons, valued at $112,504,020, as compared with 51,221,353 long tons, or 57,367,915 short tons, valued at $85,757,851 in 1900, and 53,944,647 long tons, or 60,418,005 short tons in 1899, valued at $88,142,130. The production of anthracite coal in 1900 was curtailed by labor troubles which were fully discussed in last year's report. The production fell off as compared with 1899, 2,723,294 long tons in amount, and $2,384,279 in value. The industry recovered its normal conditions in 1901, and the production increased over 1900, 9,021,207 long tons, or 17.6 per cent, with an increase in value of $26,746,169, or 31 per cent. As compared with 1899 the production increased 6,297,913 long tons in amount, and $24,361,890 in value. The most important feature in regard to the anthracite production in 1901 outside of the record-making output, was the sharp advance in values, the average price per long ton of marketed coal having risen from $1.85 in 1900 to $2.05 in 1901, and was the result of an increase of 10 per cent in wages granted to the miners in the settlement of the strikes of the preceding year, together with the general increase in values due to the industrial prosperity, which affected both branches of the coal-mining industry in 1901.

The product of bituminous coal includes lignite and brown coals, cannel, splint, block, semianthracite, semibituminous, and the small anthracite product of Colorado and New Mexico. This amounted in 1901 to 201,631,115 long tons, or 225,826,849 short tons, valued at $236,406,449, as compared with 189,566,885 long tons, or 212,314,912 short tons, valued at $220,913,513 in 1900, and 172,608,917 long tons, or 193,321,987 short tons, in 1899, valued at $167,935,304. As compared with 1900 the production of bituminous coal in 1901 showed an increase of 12,064,230 long tons, or 13,511,937 short tons in amount, and $15,492,936 in value.

Of the 29 States and Territories included in the following tables as coal producers there were only 5 whose output in 1901 did not exceed that of 1900. The 5 States in which decreases occurred were California, Idaho, Montana, New Mexico, and North Carolina. The total decreases amounted to a little over 400,000 short tons. In most of the other 24 States the production in 1901 was the largest ever obtained. Taken as a whole, the industry in 1901 was about the most prosperous in its history. Notwithstanding the large increase in production, the higher prices of bituminous coal, which were attained in 1900, were held and the value of the anthracite product was increased, in much greater proportion than the product. The few labor troubles were unimportant.

The statistics regarding the use of mining machines, which are presented in detail in another portion of this report, show that in 1901 the total amount of coal mined by mechanical means was 57,843,335 short tons, equivalent to 25.61 per cent of the total bituminous product. In 1900 the machine-mined product amounted to 52,790,523 short tons, or 25.15 per cent of the total bituminous product. There have not been any successful methods invented of mining anthracite coal by the use of machines, except where air drills are used to bore the blast holes. These are not included among coal-mining machines.

The total number of men employed in the coal mines of the United States in 1901 was 485,544, who made an average of 216 working days, as compared with 448,581 men, for an average of 212 working days in 1900. The distribution of this labor in 1901 was as follows: In the anthracite mines, 145,309 men; average of working time, 196 days. In the bituminous mines, 340,235 men; average working time, 225 days.

In considering the coal product, these reports include not only the coal marketed either by shipment to distant points or sold locally, but also that consumed by mine employees and by the mine operators in locomotives and for other power or heating purposes in connection with the mining operations. This latter factor is usually considered and reported as colliery consumption. There are occasional exceptions in the bituminous fields where operators use only slack and otherwise wasted product, of which no record is kept, and which is not reported in the production. It does not appear in the product, nor is the miner paid for mining it. These exceptions are few and the amount is comparatively small. The coal consumed in the manufacture of coke is also considered in this report. The amount of coal made into coke at the mines in 1901 was 28,314,150 short tons. The coal sold to local trade and employees, and used in the manufacture of coke, is included in the marketable product. The colliery consumption in the anthracite region, which is not considered in the value of the anthracite product, ranges from 8 to 10 per cent of the total anthracite output. The colliery consumption of the bituminous mines averages between 1½ and 2 per cent of the total bituminous product. Deducting the colliery consumption from the total in 1901, the marketable product is shown to have been 282,918,970 short tons, as compared with 260,493,081 short tons in 1900.

The details of production in 1900 and 1901, by States, together with the value, the average price per ton, and the average number of men employed, with the average working time made, are shown in the following tables:

Coal production of the United States in 1900, by States.

State.	Loaded at mines for shipment.	Sold to local trade and used by employees.	Used at mines for steam and heat.	Made into coke.	Total production.	Total value.	Average price per ton.	Average number of days active.	Average number of employees.
	Short tons.	*Short tons.*	*Short tons.*	*Short tons.*	*Short tons.*				
Alabama	6,108,011	146,591	189,474	1,950,199	8,394,275	$9,793,785	$1.17	257	13,967
Arkansas	1,396,674	10,950	40,321	....	1,447,945	1,653,618	1.14	219	2,800
California	160,508	4,550	6,650	....	171,708	523,231	3.05	309	378
Colorado	4,027,872	106,917	139,085	970,490	5,244,364	5,858,036	1.12	264	7,459
Georgia and North Carolina	175,646	1,797	9,380	146,468	333,291	393,469	1.18	262	681
Idaho	....	10	....	....	10	50	5.00	......	....
Illinois	22,955,737	2,002,884	809,360	....	25,767,981	26,927,185	1.04	226	39,101
Indiana	5,947,462	372,948	161,071	2,605	6,484,086	6,687,137	1.03	199	11,720
Indian Territory	1,796,422	14,786	54,137	56,953	1,922,298	2,788,124	1.45	228	4,525
Iowa	4,389,344	696,472	117,123	....	5,202,939	7,155,341	1.38	228	11,608
Kansas	4,128,892	286,080	52,898	....	4,467,870	5,454,691	1.22	232	8,459
Kentucky	4,783,062	286,518	92,123	167,261	5,328,964	4,881,577	.92	227	9,680
Maryland	3,949,539	51,565	23,584	....	4,024,688	3,927,381	.98	203	5,319
Michigan	792,679	40,258	16,538	....	849,475	1,259,683	1.48	261	1,704
Missouri	3,187,194	293,229	59,680	....	3,540,103	4,280,328	1.21	214	8,180
Montana	1,445,456	26,814	55,854	133,651	1,661,775	2,713,707	1.63	252	2,376
New Mexico	1,198,289	15,574	58,103	27,333	1,299,299	1,776,170	1.37	261	2,037
North Dakota	106,584	21,729	1,570	....	129,883	158,348	1.22	142	326
Ohio	17,347,472	1,292,264	277,188	71,226	18,988,150	19,292,246	1.02	215	27,628
Oregon	48,160	9,590	1,114	....	58,864	220,001	3.74	273	141
Pennsylvania	58,696,100	1,506,778	1,067,942	18,571,506	79,842,326	77,438,545	.97	242	92,692
Tennessee	2,615,253	63,320	49,451	781,538	3,509,562	4,003,082	1.14	242	7,646
Texas	954,521	4,318	9,534	....	968,373	1,581,914	1.63	246	2,844
Utah	1,082,723	17,355	18,650	28,299	1,147,027	1,447,750	1.26	248	1,308
Virginia	1,334,659	45,705	40,639	972,751	2,393,754	2,123,222	.89	239	3,631
Washington	2,318,897	26,120	69,788	59,288	2,474,093	4,700,068	1.90	289	3,670
West Virginia	18,348,162	491,051	142,071	3,662,923	22,647,207	18,416,871	.81	231	29,163
Wyoming	3,776,954	28,419	176,769	32,460	4,014,602	5,457,953	1.36	266	5,332
Total bituminous	173,072,272	7,867,592	3,740,097	27,634,951	212,314,912	220,913,513	1.04	234	304,375
Pennsylvania anthracite	50,709,816	1,208,450	5,449,649	....	57,367,915	85,757,851	1.49	166	144,206
Grand total	223,782,088	9,076,042	9,189,746	27,634,951	269,682,827	306,671,364	1.14	212	448,581

Coal production of United States in 1901, by States.

State.	Loaded at mines for shipment.	Sold to local trade and used by employees.	Used at mines for steam and heat.	Made into coke.	Total production.	Total value.	Average price per ton.	Average number of days active.	Average number of employees.
	Short tons.	*Short tons.*	*Short tons.*	*Short tons.*	*Short tons.*				
Alabama	6,616,594	85,029	214,952	2,182,477	9,099,052	$10,000,892	$1.10	236	17,370
Arkansas	1,754,527	11,926	49,683	....	1,816,136	2,068,613	1.14	221	3,144
California	132,566	597	17,916	....	151,079	394,106	2.60	289	428
Colorado	4,350,285	92,304	157,579	1,099,847	5,700,015	6,441,891	1.13	253	8,870
Georgia and North Carolina	259,581	550	3,930	90,764	354,825	426,685	1.20	291	791
Idaho	....	....	....	....	0	....	......	......	....
Illinois	24,295,861	2,156,344	879,347	....	27,331,552	28,163,937	1.03	220	41,880
Indiana	6,373,083	353,111	192,031	....	6,918,225	7,017,143	1.01	194	12,968
Indian Territory	2,249,100	31,370	83,183	58,128	2,421,781	3,915,268	1.62	208	6,706
Iowa	4,810,953	666,882	139,664	....	5,617,499	7,822,805	1.39	218	12,653
Kansas	4,539,990	287,909	72,629	....	4,900,528	5,991,599	1.22	224	9,928
Kentucky	4,947,716	273,046	87,947	161,277	5,469,986	5,213,076	.95	213	10,307
Maryland	5,043,991	41,282	27,854	....	5,113,127	5,046,491	.99	262	5,333
Michigan	1,158,096	44,749	38,396	....	1,241,241	1,753,064	1.41	247	2,276
Missouri	3,411,123	332,732	58,233	....	3,802,088	4,707,164	1.24	223	9,871
Montana	1,210,665	40,842	41,624	102,950	1,396,081	2,009,316	1.44	231	2,158
New Mexico	1,023,010	15,624	33,617	14,295	1,086,546	1,546,652	1.42	224	2,478
North Dakota	134,664	26,775	5,162	....	166,601	214,151	1.29	198	280
Ohio	19,303,851	1,366,378	264,478	9,100	20,943,807	20,928,158	1.00	198	32,111
Oregon	53,472	14,531	1,008	....	69,011	173,646	2.52	228	187
Pennsylvania	60,165,317	1,681,282	1,339,096	19,120,251	82,305,946	81,397,586	.99	230	101,904
Tennessee	2,807,931	78,979	60,461	685,919	3,633,290	4,067,389	1.12	228	9,046
Texas	1,084,381	4,425	19,147	....	1,107,953	1,907,024	1.72	264	3,051
Utah	1,272,848	18,333	30,446	987	1,322,614	1,666,082	1.26	259	1,712
Virginia	1,390,724	16,011	28,752	1,290,386	2,725,873	2,353,989	.86	279	4,152
Washington	2,400,276	18,553	75,678	83,710	2,578,217	4,271,076	1.66	276	4,545
West Virginia	19,859,809	574,746	255,618	3,378,229	24,068,402	20,848,184	.87	219	30,935
Wyoming	4,222,524	31,961	195,059	35,830	4,485,374	6,060,462	1.35	248	5,151
Total bituminous	184,872,938	8,266,271	4,373,490	28,314,150	225,826,849	236,406,449	1.05	225	340,235
Pennsylvania anthracite	60,137,874	1,327,737	6,006,056	....	67,471,667	112,504,020	1.67	196	145,309
Grand total	245,010,812	9,594,008	10,379,546	28,314,150	293,298,516	348,910,469	1.19	216	485,544

PRODUCTION IN PREVIOUS YEARS.

In the following table are shown the amount and value of the coal produced in the United States for the last six years, with the increases and decreases in 1901 as compared with 1900:

Amount and value of coal produced in the United States, etc.

State or Territory.	1896.		1897.		1898.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Short tons.		*Short tons.*		*Short tons.*	
Alabama	5,748,697	$5,174,135	5,893,770	$5,192,085	6,535,283	$4,932,776
Arkansas	675,374	755,577	856,190	903,993	1,205,479	1,238,778
California	[a] 93,776	220,523	[a] 103,912	265,236	[a] 160,288	405,915
Colorado	3,112,400	3,606,642	3,361,703	3,947,186	4,076,347	4,686,081
Georgia and North Carolina.	246,359	179,770	217,149	167,466	255,682	212,537
Idaho	....	....	[b] 645	2,150	[b] 1,039	2,675
Illinois	19,786,626	15,809,736	20,072,758	14,472,529	18,599,299	14,567,598
Indiana	3,905,779	3,261,737	4,151,169	3,472,348	4,920,743	3,994,918
Indian Territory	1,366,646	1,918,115	1,336,380	1,787,358	1,381,466	1,827,638
Iowa	3,954,028	4,628,022	4,611,865	5,219,503	4,618,842	5,260,716
Kansas	2,884,801	3,295,032	3,054,012	3,602,326	3,406,555	3,703,014
Kentucky	3,333,478	2,684,306	3,602,097	2,828,329	3,887,908	3,084,551
Maryland	4,143,936	3,299,928	4,442,128	3,363,996	4,674,884	3,532,257
Michigan	92,882	150,631	223,592	325,416	315,722	462,711
Missouri	2,331,542	2,518,194	2,665,626	2,887,884	2,688,321	2 871,296
Montana	1,543,445	2,279,672	1,647,882	2,897,408	1,479,803	2,324,207
Nebraska	(*c*)	(*c*)	(*d*)	(*d*)	(*d*)	(*d*)
New Mexico	622,626	930,381	716,981	991,611	992,288	1,344,750
North Dakota	78,050	84,908	77,246	83,803	83,895	93,591
Ohio	12,875,202	10,253,461	12,196,942	9,535,409	14,516,867	12,027,336
Oregon	101,721	294,564	101,755	313,890	58,184	212,184
Pennsylvania:						
Anthracite	54,346,081	81,748,651	52,611,680	79,301,954	53,382,644	75,414,537
Bituminous	49,557,453	35,368,249	54,417,974	37,463,519	65,165,133	43,352,588
Tennessee	2,663,106	2,281,295	2,888,849	2,329,534	3,022,896	2,337,512
Texas	544,015	896,251	639,341	972,323	686,734	1,139,763
Utah	418,627	500,547	521,560	618,230	593,709	752,252
Virginia	1,254,723	848,851	1,528,302	1,021,918	1,815,274	1,070,417
Washington	1,195,504	2,396,078	1,434,112	2,777,687	1,884,571	3,352,798
West Virginia	12,876,296	8,336,685	14,248,159	8,987,393	16,700,999	10,131,264
Wyoming	[e] 2,233,184	2,918,225	2,597,886	3,136,694	2,863,812	3,664,190
Total	191,986,357	196,640,166	200,221,665	198,869,178	219,974,667	208,000,850

[a] Includes Alaska.

[b] Includes Nebraska.

[c] Included in Wyoming.

[d] Included in Idaho.

[e] Includes Nebraska.

Amount and value of coal produced in the United States, etc.—Continued.

State or Territory.	1899.		1900.		1901.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Short tons.		*Short tons.*		*Short tons.*	
Alabama	7,593,416	$8,256,462	8,394,275	$9,793,785	9,099,052	$10,000,892
Arkansas	843,554	989,383	1,447,945	1,653,618	1,816,136	2,068,613
California	160,972	430,636	171,708	523,231	151,079	394,106
Colorado	4,776,224	5,363,667	5,244,364	5,858,036	5,700,015	6,441,891
Georgia and North Carolina.	260,007	268,309	333,291	393,469	354,825	426,685
Idaho	20	100	10	50	....	....
Illinois	24,439,019	20,744,553	25,767.981	26,927,185	27,331,552	28,163,937
Indiana	6,006,523	5,285,018	6,484,086	6,687,137	6,918,225	7,017,143
Indian Territory	1,537,427	2,199,785	1,922,298	2,788,124	2,421,781	3,915,268
Iowa	5,177,479	6,397,338	5,202,939	7,155,341	5,617,499	7,822,805
Kansas	3,852,267	4,478,112	4,467,870	5,454,691	4,900,528	5,991,599
Kentucky	4,607,255	3,618,222	5,328,964	4,881,577	5,469,986	5,213,076
Maryland	4,807,396	3,667,056	4,024,688	3,927,381	5,113,127	5,046,491
Michigan	624,708	870,152	849,475	1,259,683	1,241,241	1,753,064
Missouri	3,025,814	3,591,945	3,540,103	4,280,328	3,802,088	4,707,164
Montana	1,496,451	2,347,757	1,661,775	2,713,707	1,396,081	2,009,316
New Mexico	1,050,714	1,461,865	1,299,299	1,776,170	1,086,546	1,546,652
North Dakota	98,809	117,500	129,883	158,348	166,601	214,151
Ohio	16,500,270	14,361,903	18,988,150	19,292,246	20,943,807	20,928,158
Oregon	86,888	260,917	58,864	220,001	69,011	173,646
Pennsylvania:						
Anthracite	60,418,005	88,142,130	57,367,915	85,757,851	67,471,667	112,504,020
Bituminous	74,150,175	56,247,791	79,842,326	77,438,545	82,305,946	81,397,586
Tennessee	3,330,659	2,940,644	3,509,562	4,003,082	3,633,290	4,067,389
Texas	883,832	1,334,895	968,373	1,581,914	1,107,953	1,907,024
Utah	786,049	997,271	1,147,027	1,447,750	1,322,614	1,666,082
Virginia	2,105,791	1,304,241	2,393,754	2,123,222	2,725,873	2,353,989
Washington	2,029,881	3,603,989	2,474,093	4,700,068	2,578,217	4,271,076
West Virginia	19,252,995	12,053,268	22,647,207	18,416,871	24,068,402	20,848,184
Wyoming	3,837,392	4,742,525	4,014,602	5,457,953	4,485,374	6,060,462
Total	253,739,992	256,077,434	269,682,827	306,671,364	293,298,516	348,910,469

State or Territory.	Increase, 1901.		Percent of increase.	
	Quantity.	Value.	Quantity.	Value.
	Short tons.			
Alabama	704,777	$207,107	8.4	2.1
Arkansas	368,191	414,995	25.4	25.0
California	[a]20,629	[a]129,125	[a]12.0	[a]24.6
Colorado	455,651	583,855	8.7	9.9
Georgia and North Carolina	21,534	33,216	6.4	8.4
Idaho	[a]10	[a]50	[a]100.0	[a]100.0
Illinois	1,563,571	1,236,752	6.0	4.5
Indiana	434,139	330,006	6.6	4.9
Indian Territory	499,483	1,127,144	26.0	40.4
Iowa	414,560	667,464	7.9	9.3
Kansas	432,658	536,908	9.7	9.8
Kentucky	141,022	331,499	2.6	6.7
Maryland	1,088,439	1,119,110	27.0	28.4
Michigan	391,766	493,381	46.1	39.1
Missouri	261,985	426,836	7.4	9.9
Montana	[a]265,694	[a]704,391	[a]15.9	[a]25.9

[a] Decrease.

Amount and value of coal produced in the United States, etc.—Continued.

State or Territory.	Increase, 1901.		Per cent of increase.	
	Quantity.	Value.	Quantity.	Value.
	Short tons.			
New Mexico	[a]212,753	[a]$229,518	[a]16.3	[a]12.9
North Dakota	36,718	55,803	28.3	35.2
Ohio	1,955,657	1,635,912	10.3	8.5
Oregon	10,147	[a]46,355	17.2	[a]21.0
Pennsylvania:				
Anthracite	10,103,752	26,746,169	17.6	31.1
Bituminous	2,463,620	3,959,041	3.0	5.1
Tennessee	123,728	64,307	3.5	1.6
Texas	139,580	325,110	14.4	20.5
Utah	175,587	218,332	15.3	15.0
Virginia	332,119	230,767	13.8	10.8
Washington	104,124	[a]428,992	4.2	[a]9.1
West Virginia	1,421,195	2,431,313	6.3	13.2
Wyoming	470,772	602,509	11.7	11.0
Total	23,615,689	42,239,105	8.8	13.8

[a] Decrease.

There were 28 States in which coal was produced in the United States in 1901 as against 29 in 1900. The decrease of 1 in the number of coal-producing States is due to the fact that Idaho, from which a product of 10 tons was reported in 1900, did not produce any coal in 1901. Of these 28 coal-producing States, last year 22 exceeded all previous records in their history as coal-producing States. Of the 6 whose production last year had been previously exceeded, 2, California and Oregon, were on the Pacific Coast; 2, Montana and New Mexico, were in the Rocky Mountain region; 1, Missouri, was in the Western field; and 1, North Carolina, was in the Eastern States. California, Montana, New Mexico, and North Carolina all had a smaller production in 1901 than in 1900. The greatest increase in 1901 was in the production of anthracite coal in Pennsylvania. Pennsylvania is also credited with the largest increase in bituminous product, followed by Ohio, Illinois, West Virginia, and Maryland in the order named. Each of these States increased its output in 1901 over 1900 by more than 1,000,000 tons. The greatest percentage of increase is credited to Michigan, whose product gained 46 per cent over the preceding year. The entire gain for the United States was 23,615,689 short tons, or 8.8 per cent in amount, and $42,239,105, or 13.8 per cent in value.

In the following table is presented a statement of the annual production of anthracite and bituminous coal in the United States since 1880, a period of twenty-two years. It is interesting to note in connection with this table the rapid growth of the bituminous or soft coal industry, as compared with that of anthracite or hard coal. In another part of this report the adverse conditions which have from time to time affected the anthracite industry are discussed in detail. It is only necessary to refer here to the actual effect shown by the increasing use of bituminous coal, of coke, and of gas to the displacement of anthracite coal, first as a manufacturing fuel, and then as a domestic one. For manufacturing purposes bituminous coal is rapidly superseding anthracite, except in those Eastern cities where rigid smoke-preventing ordinances are enforced, and even in these cases by the use of smoke-consuming devices, bituminous coal is supplanting anthracite to an appreciable extent, while coke and gas, the products of bituminous coal, have made decided inroads into the anthracite household trade. From the following table it is seen that the production of anthracite coal has increased from 25,580,189 long tons in 1880, to 60,242,560 long tons in 1901, that is to say that the output last year was not quite 2.4 times the output in 1880. Bituminous coal, on the other hand, has increased in the same period from 38,242,641 long tons, to 201,631,115 long tons, the production last year being more than five times as much as that of 1880. The total production has increased from 63,822,830 long tons to 261,873,675 long tons, and the value from $95,640,396 to $348,910,469. The value of the coal product alone of the United States in 1901 was almost equal to that of the entire mineral product of the country in 1880.

Annual production of coal in the United States since 1880, inclusive.

Year.	Pennsylvania anthracite.			Bituminous coal.		
	Quantity.		Value.	Quantity.		Value.
	Long tons.	*Short tons.*		*Long tons.*	*Short tons.*	
1880	25,580,189	28,649,811	$42,196,678	38,242,641	42,831,758	$53,443,718
1881	28,500,016	31,920,018	64,125,036	48,365,341	53,961,012	60,224,344
1882	31,358,264	35,121,256	70,556,094	60,861,190	68,164,533	76,076,487
1883	34,336,469	38,456,845	77,257,055	68,531,500	76,755,280	82,237,800
1884	33,175,756	37,156,847	66,351,512	73,730,539	82,578,204	77,417,066
1885	34,228,548	38,335,974	76,671,948	64,840,668	72,621,548	82,347,648
1886	34,853,077	39,035,446	76,119,120	66,646,947	74,644,581	78,481,056
1887	37,578,747	42,088,197	84,552,181	79,073,227	88,562,014	98,004,656
1888	41,624,611	46,619,564	89,020,483	91,107,002	102,039,843	101,860,529
1889	40,665,152	45,544,970	65,721,578	85,432,717	95,684,643	94,504,745
1890	41,489,858	46,468,641	66,383,772	99,377,073	111,302,322	110,420,801
1891	45,236,992	50,665,431	73,944,735	105,268,962	117,901,237	117,188,400
1892	46,850,450	52,472,504	82,442,000	113,264,792	126,856,567	125,124,381
1893	48,185,306	53,967,543	85,687,078	114,629,671	128,385,231	122,751,618
1894	46,358,144	51,921,121	78,488,063	106,089,647	118,820,405	107,653,501
1895	51,785,122	57,999,337	82,019,272	120,641,244	135,118,193	115,779,771
1896	48,523,287	54,346,081	81,748,651	122,893,104	137,640,276	114,891,515
1897	46,974,714	52,611,680	79,301,954	131,794,630	147,609,985	119,567,224
1898	47,663,076	53,382,644	75,414,537	148,742,878	166,592,023	132,586,313
1899	53,944,647	60,418,005	88,142,130	172,608,917	193,321,987	167,935,304
1900	51,221,353	57,367,915	85,757,851	189,566,885	212,314,912	220,913,513
1901	60,242,560	67,471,667	112,504,020	201,631,115	225,826,849	236,406,449

Annual production of coal in the United States since 1880, inclusive—Continued.

Year.	Total.		
	Quantity.		Value.
	Long tons.	*Short tons.*	
1880	63,822,830	71,481,569	$95,640,396
1881	76,865,357	85,881,030	124,349,380
1882	92,219,454	103,285,789	146,632,581
1883	102,867,969	115,212,125	159,494,855
1884	106,906,295	119,735,051	143,768,578
1885	99,069,216	110,957,522	159,019,596
1886	101,500,024	113,680,027	154,600,176
1887	116,651,974	130,650,211	182,498,737
1888	132,731,613	148,659,407	190,881,012
1889	126,097,869	141,229,613	160,226,323
1890	140,866,931	157,770,963	176,804,573
1891	150,505,954	168,566,668	191,133,135
1892	160,115,242	179,329,071	207,566,381
1893	162,814,977	182,352,774	208,438,696
1894	152,447,791	170,741,526	186,141,564
1895	172,426,366	193,117,530	197,799,043
1896	171,416,390	191,986,357	196,640,166
1897	178,769,344	200,221,665	198,869,178
1898	196,405,953	219,974,667	208,000,850
1899	226,553,564	253,739,992	256,077,434
1900	240,788,238	269,682,827	306,671,364
1901	261,873,675	293,298,516	348,910,469

The statistics regarding the distribution for consumption of the coal product of the United States have been collected only since 1889. They are shown in the following table, together with the value and the statistics of labor employed and the average working time made:

Distribution of coal product of the United States from 1889 to 1901, inclusive.

Year.	Loaded at mines for shipment.	Sold to local trade and used by employees.	Used at mines for steam and heat.	Made into coke.
	Short tons.	*Short tons.*	*Short tons.*	*Short tons.*
1889	113,776,701	8,508,699	5,382,265	13,561,848
1890	128,383,658	9,009,285	5,063,953	15,331,760
1891	92,615,738	7,816,891	1,750,169	15,718,440
1892	146,372,098	9,704,678	6,210,767	17,041,528
1893	152,941,890	9,728,815	6,712,284	12,969,785
1894	142,833,319	8,764,538	6,307,296	12,836,373
1895	158,380,289	9,655,505	6,677,539	18,404,197
1896	159,176,155	9,502,927	7,184,832	16,122,443
1897	165,603,626	9,914,742	6,941,419	17,761,878
1898	180,960,111	8,925,914	7,921,289	22,167,353
1899	208,754,746	9,074,556	8,662,864	27,247,826
1900	223,782,088	9,076,042	9,189,746	27,634,951
1901	245,010,812	9,594,008	10,379,546	28,308,650

Distribution of coal product of the United States from 1889 to 1901, inclusive—Continued.

Year.	Total product.	Total value.	Average price per ton.	Average number of days active.	Average number of employees.
	Short tons.				
1889	141,229,513	$160,226,323	$1.13	....	....
1890	157,788,656	176,804,573	1.12	216	318,204
1891	117,901,238	117,188,400	.994	223	205,803
1892	179,329,071	207,566,381	1.16	212	341,943
1893	182,352,774	208,438,696	1.14	201	363,309
1894	170,741,526	186,141,564	1.09	178	376,206
1895	193,117,530	197,799,043	1.02	195	382,879
1896	191,986,357	196,640,166	1.02	185	386,656
1897	200,221,665	198,869,178	.99	179	397,701
1898	219,974,667	208,000,850	.95	190	401,221
1899	253,739,992	256,077,434	1.01	214	410,635
1900	269,682,827	306,671,364	1.14	212	448,581
1901	293,298,516	348,910,469	1.19	216	485,544

RANK OF COAL-PRODUCING STATES.

In the following table, which extends over a period of three years, the coal-producing States are arranged according to rank, first in amount of production and then in the value of the product, with the percentage of both amount and value contributed by each State. Pennsylvania, of course, stands preeminently at the head, contributing more than 51 per cent of the total production and nearly 56 per cent of the value. Illinois stands second in both instances, with 9.3 per cent of the total production and 8.1 per cent of the value. For several years West Virginia has held third place in amount of coal produced, but fell behind Ohio in the value. In 1901 West Virginia held the same position, with 8.2 per cent of the production and 6 per cent of the value. Ohio contributed 7.1 per cent of the production and 6 per cent of the value. The other States retained nearly the same relative positions in 1901 as in 1900, except that Michigan advanced over both Texas and New Mexico.

Rank of coal-producing States in 1900, with amount of production, value of product, and percentage of each.

Production.				Value.			
Rank.	State or Territory.	Amount.	Per cent of total production.	Rank.	State or Territory.	Value.	Per cent of total value.
1	Pennsylvania:	*Short tons.*		1	Pennsylvania:		
	Anthracite	57,367,915	21.3		Anthracite	$85,757,851	27.9
	Bituminous	79,842,326	29.6		Bituminous	77,438,545	25.2
2	Illinois	25,767,981	9.6	2	Illinois	26,927,185	8.8
3	West Virginia	22,647,207	8.4	3	Ohio	19,292,246	6.3
4	Ohio	18,988,150	7.0	4	West Virginia	18,416,871	6.0
5	Alabama	8,394,275	3.1	5	Alabama	9,793,785	3.2
6	Indiana	6,484,086	2.4	6	Iowa	7,155,341	2.3
7	Kentucky	5,328,964	2.0	7	Indiana	6,687,137	2.2
8	Colorado	5,244,364	1.9	8	Colorado	5,858,036	1.9
9	Iowa	5,202,939	1.9	9	Wyoming	5,457,953	1.8
10	Kansas	4,467,870	1.7	10	Kansas	5,454,691	1.8
11	Maryland	4,024,688	1.5	11	Kentucky	4,881,577	1.6
12	Wyoming	4,014,602	1.5	12	Washington	4,700,068	1.5
13	Missouri	3,540,103	1.3	13	Missouri	4,280,328	1.4
14	Tennessee	3,509,562	1.3	14	Tennessee	4,003,082	1.4
15	Washington	2,474,093	0.9	15	Maryland	3,927,381	1.3
16	Virginia	2,393,754	0.9	16	Indian Territory	2,788,124	0.9
17	Indian Territory	1,922,298	0.7	17	Montana	2,713,707	0.9
18	Montana	1,661,775	3.0	18	Virginia	2,123,222	3.6
19	Arkansas	1,447,945		19	New Mexico	1,776,170	
20	New Mexico	1,299,299		20	Arkansas	1,653,618	
21	Utah	1,147,027		21	Texas	1,581,914	
22	Texas	968,373		22	Utah	1,447,750	
23	Michigan	849,475		23	Michigan	1,259,683	
24	Georgia	[a]333,291		24	California	523,231	
25	California	171,708		25	Georgia	393,469	
26	North Dakota	129,883		26	Oregon	220,001	
27	Oregon	58,864		27	North Dakota	158,348	
28	Idaho	10		28	Idaho	50	
	Total	269,682,827	100.0		Total	306,671,364	100.0

[a] Includes North Carolina.

Rank of coal-producing States in 1901, with amount of production, value of product, and percentage of each.

Production.				Value.			
Rank.	State or Territory.	Amount.	Per cent of total production.	Rank.	State or Territory.	Value.	Per cent of total value.
1	Pennsylvania:	*Short tons.*		1	Pennsylvania:		
	Anthracite	67,471,667	23.0		Anthracite	$112,504,020	32.2
	Bituminous	82,305,946	28.1		Bituminous	81,397,586	23.3
2	Illinois	27,331,552	9.3	2	Illinois	28,163,937	8.1
3	West Virginia	24,068,402	8.2	3	Ohio	20,928,158	6.0
4	Ohio	20,943,807	7.1	4	West Virginia	20,848,184	6.0
5	Alabama	9,099,052	3.1	5	Alabama	10,000,892	2.9
6	Indiana	6,918,225	2.4	6	Iowa	7,822,805	2.2
7	Colorado	5,700,015	2.0	7	Indiana	7,017,143	2.0
8	Iowa	5,617,499	1.9	8	Colorado	6,441,891	1.8
9	Kentucky	5,469,986	1.9	9	Wyoming	6,060,462	1.7
10	Maryland	5,113,127	1.7	10	Kansas	5,991,599	1.7
11	Kansas	4,900,528	1.7	11	Kentucky	5,213,076	1.5
12	Wyoming	4,485,374	1.5	12	Maryland	5,046,491	1.5
13	Missouri	3,802,088	1.3	13	Missouri	4,707,164	1.4
14	Tennessee	3,633,290	1.2	14	Washington	4,271,076	1.2
15	Virginia	2,725,873	.9	15	Tennessee	4,067,389	1.2
16	Washington	2,578,217	.9	16	Indian Territory	3,915,268	1.1
17	Indian Territory	2,421,781	.8	17	Virginia	2,353,989	.7
18	Arkansas	1,816,136	3.0	18	Arkansas	2,068,613	3.5
19	Montana	1,396,081		19	Montana	2,009,316	
20	Utah	1,322,614		20	Texas	1,907,024	
21	Michigan	1,241,241		21	Michigan	1,753,064	
22	Texas	1,107,953		22	Utah	1,666,082	
23	New Mexico	1,086,546		23	New Mexico	1,546,652	
24	Georgia	354,825		24	Georgia	426,685	
25	North Dakota	166,601		25	California	394,106	
26	California	151,079		26	North Dakota	214,151	
27	Oregon	69,011		27	Oregon	173,646	
	Total	293,298,516	100.0		Total	348,910,469	100.0

LABOR STATISTICS.

The following tables show the number of men employed and the average number of days made by each during the last four years, by States, and the total number of men employed in the anthracite and bituminous fields of the United States, with the average time since 1890:

Statistics of labor employed in coal mines of the United States since 1898.

State or Territory.	1898.		1899.		1900.		1901.	
	Number of days active.	Average number employed.	Number of days active.	Average number employed.	Number of days active.	Average number employed.	Number of days active.	Average number employed.
Alabama	250	10,733	238	13,481	257	13,967	236	17,370
Arkansas	163	2,555	156	2,313	219	2,800	221	3,144
California	[a] 265	284	[a] 287	369	309	378	289	428
Colorado	220	6,440	246	7,166	264	7,459	253	8,870
Georgia	[b] 292	534	[b] 291	637	[b] 262	681	[b] 291	791
Idaho	157	7	....	....	....	....	....	....
Illinois	175	35,026	228	36,756	226	39,101	220	41,880
Indiana	199	8,971	218	9,712	199	11,720	194	12,968
Indian Territory	198	3,216	212	4,084	228	4,525	208	6,706
Iowa	219	10,262	229	10,971	228	11,608	218	12,653
Kansas	194	7,197	226	8,000	232	8,459	224	9,928
Kentucky	187	7,614	224	7,461	227	9,680	213	10,307
Maryland	253	4,818	275	4,624	203	5,319	262	5,333
Michigan	245	715	232	1,291	261	1,704	247	2,276
Missouri	198	6,542	212	7,136	214	8,180	223	9,871
Montana	216	2,359	238	2,378	252	2,376	231	2,158
New Mexico	242	1,873	257	1,750	261	2,037	224	2,478
North Dakota	187	151	154	210	142	326	198	280
Ohio	169	26,986	200	26,038	215	27,628	198	32,111
Oregon	142	199	238	124	273	141	228	137
Pennsylvania, bituminous	229	79,611	245	82,812	242	92,692	230	101,904
Tennessee	234	6,643	252	6,949	242	7,646	228	9,046
Texas	245	2,130	256	2,410	246	2,844	264	3,051
Utah	243	739	265	743	248	1,308	259	1,712
Virginia	230	1,855	252	1,960	239	3,631	279	4,152
Washington	270	3,145	259	3,330	289	3,670	276	4,545
West Virginia	218	21,607	242	23,625	231	29,163	219	30,935
Wyoming	242	3,475	261	4,697	266	5,332	248	5,151
Total	211	255,717	234	271,027	234	304,375	225	340,235
Pennsylvania, anthracite	152	145,504	173	139,608	166	144,206	196	145,309
Grand total	190	401,221	214	410,635	212	448,581	216	485,544

[a] Includes Alaska.

[b] Includes North Carolina.

Statistics of labor employed in coal mines of the United States since 1890.

Year.	Pennsylvania anthracite.		Bituminous.	
	Number of days active.	Average number employed.	Number of days active.	Average number employed.
1890	200	126,000	226	192,204
1891	203	126,350	223	205,803
1892	198	129,050	219	212,893
1893	197	132,944	204	230,365
1894	190	131,603	171	244,603
1895	196	142,917	194	239,962
1896	174	148,991	192	244,171
1897	150	149,884	196	247,817
1898	152	145,504	211	255,717
1899	173	139,608	234	271,027
1900	166	144,206	234	304,375
1901	196	145,309	225	340,235

From the preceding tables, showing the production and the statistics of labor employed, the following table, in which is shown the average daily and annual tonnage per man, has been compiled. It shows that in 1890 the annual production per man employed in the anthracite region was 369 short tons. The average tonnage per man per day was 1.845 short tons. In the bituminous region it was 579 short tons per man per year, and 2.56 short tons per man per day. In 1901 the anthracite employees produced an average of 464 short tons per man per year. The average production per day per man was 2.36 short tons. The average production of bituminous coal per man in 1901 was 664 short tons. The average tonnage per man per day last year in the bituminous fields was 2.94 short tons. The average efficiency, or daily tonnage per man, in the anthracite region has decreased from 2.50 in 1899 to 2.36 in 1901; the bituminous average has decreased from 3.05 to 2.94.

Production of anthracite coal according to number of persons employed.

Year.	Men employed.	Days worked.	Average tonnage per man per day.	Average tonnage per man per year.
1890	126,000	200	1.85	369
1891	126,350	203	1.98	401
1892	129,050	198	2.06	407
1893	132,944	197	2.06	406
1894	131,603	190	2.08	395
1895	142,917	196	2.07	406
1896	148,991	174	2.10	365
1897	149,884	150	2.34	351
1898	145,504	152	2.41	367
1899	139,608	173	2.50	433
1900	144,206	166	2.40	398
1901	145,309	196	2.36	464

Production of bituminous coal according to number of persons employed.

Year.	Men employed.	Days worked.	Average tonnage per man per day.	Average tonnage per man per year.
1890	192,204	226	2.56	579
1891	205,803	223	2.57	573
1892	212,893	219	2.72	596
1893	230,365	204	2.73	557
1894	244,603	171	2.84	486
1895	239,962	194	2.90	563
1896	244,171	192	2.94	564
1897	247,817	196	3.04	596
1898	255,717	211	3.09	651
1899	271,027	234	3.05	713
1900	304,375	234	2.98	697
1901	340,235	225	2.94	664

COAL-MINING ACCIDENTS.

In the following table is presented a statement in regard to the number of fatal and nonfatal accidents which occurred during 1901 in those States from which it has been possible to secure statistics from mine inspectors or other authorities. The States and Territories for which the statistics are available and the authorities from whom the statements have been received are as follows:

Alabama, from the annual report of J. B. D. Hooper, chief mine inspector; Arkansas, from Mr. Martin Rafter, State mine inspector; Colorado, from Mr. Henry Denman, State coal-mine inspector; Illinois, from the annual report of David Ross, secretary of the bureau of labor statistics; Indian Territory, from Mr. Franklin Bache, president of the McAlester Coal Company; Iowa, biennial report of State mine inspectors; Kansas, from Mr. D. R. Casselman, State secretary of mine industries; Kentucky, from Mr. C. J. Norwood, State inspector of mines; Maryland, from Mr. James P. Carroll, State mine inspector; Michigan, from the nineteenth annual report of the bureau of labor; Missouri, from the annual report of Mr. Charles Evans, inspector of coal mines; New Mexico, from the annual report of the Territorial mine inspector; Ohio, from Mr. R. M. Hazeltine, of Columbus; Pennsylvania, from advance proofs of the annual report of Mr. James E. Roderick, chief of the bureau of mines; Utah, from the annual report of Mr. Gomer Thomas, State mine inspector; Washington, from Mr. C. F. Owen, State inspector of coal mines; West Virginia, from Mr. James W. Paul, chief mine inspector; Wyoming, from Mr. Noah Young, State mine inspector. The writer desires to express his sincere appreciation of the numerous courtesies extended by these gentlemen in reply to continued demands upon their time and attention.

In the 18 States mentioned above, from which these statistics have been received, the total number of lives lost in 1901 was 1,467.

The total number of men injured was 3,643. The number of tons of coal mined for each life lost varied from 426,094 in Maryland to 49,424 in Indian Territory. The average number of tons mined for each of the 1,467 lives lost in these 18 States was 188,668. It is interesting to note that in Pennsylvania the number of tons of bituminous coal mined per life lost was a little more than double the amount mined per life lost in the anthracite mines in the same State. Maryland enjoys the distinction of the largest tonnage per life lost, while the Indian Territory has the largest percentage of deaths for the tonnage mined. In the following table are shown the details of accidents, together with the number of wives made widows and the number of children made fatherless, for the States from which it has been possible to secure the figures:

Fatal and nonfatal accidents in coal mines of United States in 1901.

State.	Number of men killed.	Number of men injured.	Number of wives made widows.	Number of children made fatherless.	Number of tons mined for each life lost.
Alabama	41	(a)	(a)	(a)	221,928
Arkansas	18	63	14	38	100,896
Colorado	55	81	(a)	(a)	103,637
Illinois[b]	99	422	55	139	263,716
Indiana	(a)	(a)	(a)	(a)	(a)
Indian Territory	49	98	26	(a)	49,424
Iowa	29	59	(a)	(a)	193,707
Kansas	16	35	9	(a)	304,985
Kentucky	21	109	12	24	273,499
Maryland	12	110	6	21	426,094
Michigan	6	18	(a)	(a)	206,874
Missouri	15	16	8	14	253,333
Montana	(a)	(a)	(a)	(a)	(a)
New Mexico[b]	9	11	(a)	(a)	135,281
Ohio	72	432	(a)	(a)	290,886
Pennsylvania:					
Anthracite	513	1,243	277	624	131,524
Bituminous	301	656	184	412	273,288
Tennessee	(a)	(a)	(a)	(a)	(a)
Utah	9	12	(a)	(a)	146,957
Virginia	(a)	(a)	(a)	(a)	(a)
Washington	27	82	4	11	95,489
West Virginia	134	184	58	90	179,525
Wyoming	41	12	18	37	109,399
Total for 18 States and Territories	1,467	3,643	....	....	[c]188,668

[a] Not reported. [b] Fiscal year ending June 30, 1901. [c] Average.

PRICES.

The following table shows the fluctuations in the average prices prevailing in each State since 1895, and also the average prices for anthracite and bituminous coal in the United States since 1880. These averages are obtained by dividing the total product, including colliery consumption, into the total value.

Average prices for coal at the mines since 1895.

[Per short ton.]

State or Territory.	1895.	1896.	1897.	1898.	1899.	1900.	1901.
Alabama	$0.90	$0.90	$0.88	$0.75	$1.09	$1.17	$1.10
Arkansas	1.25	1.11	1.06	1.03	1.17	1.14	1.14
California	2.33	[a]2.35	[a]2.55	[a]2.53	[a]2.68	3.05	2.60
Colorado	1.20	1.16	1.17	1.15	1.12	1.12	1.13
Georgia	.83	.70	.72	.81	1.00	1.17	1.20
Idaho	....	....	[b]3.33	2.57	5.00	5.00	....
Illinois	.80	.80	.72	.78	.85	1.04	1.03
Indiana	.91	.84	.84	.81	.88	1.03	1.01
Indian Territory	1.43	1.40	1.34	1.32	1.43	1.45	1.62
Iowa	1.20	1.17	1.13	1.14	1.24	1.38	1.39
Kansas	1.20	1.15	1.18	1.09	1.16	1.22	1.22
Kentucky	.86	.78	.79	.79	.79	.92	.95
Maryland	.81	.80	.76	.76	.76	.98	.99
Michigan	1.60	1.62	1.46	1.47	1.39	1.48	1.41
Missouri	1.12	1.08	1.08	1.07	1.20	1.21	1.24
Montana	1.89	1.47	1.76	1.57	1.57	1.63	1.44
New Mexico	1.49	1.49	1.38	1.35	1.39	1.37	1.42
North Carolina	1.66	1.50	1.34	1.25	1.30	1.32	1.25
North Dakota	1.07	1.09	1.08	1.11	1.19	1.22	1.29
Ohio	.79	.79	.78	.83	.87	1.02	1.00
Oregon	3.36	2.90	3.09	3.65	3.00	3.74	2.52
Pennsylvania bituminous	.72	.71	.69	.67	.76	.97	.99
Tennessee	.93	.86	.81	.77	.88	1.14	1.12
Texas	1.88	1.65	1.52	1.66	1.51	1.63	1.72
Utah	1.31	1.20	1.19	1.27	1.27	1.26	1.26
Virginia	.63	.68	.67	.59	.62	.89	.86
Washington	2.16	2.00	1.94	1.78	1.78	1.90	1.66
West Virginia	.68	.65	.63	.61	.63	.81	.87
Wyoming	1.33	[b]1.37	1.21	1.28	1.24	1.36	1.35
Total bituminous	.86	.83	.81	.80	.87	1.04	1.04
Pennsylvania anthracite	1.41	1.50	1.51	1.41	1.46	1.49	1.67
General average	1.02	1.02	.99	.95	1.01	1.14	1.19

[a] Includes Alaska.

[b] Includes Nebraska.

Average price per short ton of coal in United States for 22 years.

Year.	Anthracite.	Bituminous.	Year.	Anthracite.	Bituminous.
1880	$1.47	$1.25	1891	$1.46	$0.99
1881	2.01	1.12	1892	1.57	.99
1882	2.01	1.12	1893	1.59	.96
1883	2.01	1.07	1894	1.51	.91
1884	1.79	.94	1895	1.41	.86
1885	2.00	1.13	1896	1.50	.83
1886	1.95	1.05	1897	1.51	.81
1887	2.01	1.11	1898	1.41	.80
1888	1.91	1.00	1899	1.46	.87
1889	1.44	.99	1900	1.49	1.04
1890	1.43	.99	1901	1.67	1.05

COAL MINED BY MACHINES.

One of the most striking results obtained by the compilation of the statistics of coal production in 1901 was the fact that in quite a large number of States the tonnage obtained by machines showed a decided falling off. This was principally shown, however, in the less important States.

There were 11 States in which the amount of coal undercut by machines in 1901 was less than in 1900, but, in spite of this, the amount of machine-mined tonnage last year shows a substantial gain over 1900. The total machine-mined product reported for 1901 was 57,843,335 short tons, as compared with 52,784,523 short tons in 1900, an increase of 5,058,812 short tons, or a little over 9 per cent. By this it will be seen that the machine-mined product in 1901 bore nearly the same relation to the total as it did in 1900; there was, indeed, a slight gain in this respect in 1901. In 1900 the machine-mined product was equal to 25.15 per cent of the total bituminous output. In 1901 it was 25.68 per cent of the total. There were 24 States in which machines were used in 1901, a gain of two over 1900. Both Texas and Utah reported some machine-mined coal last year, whereas the former State had not reported any since 1898, and Utah none since 1896. The States in which the machine-mined tonnage increased and decreased were nearly equally divided so far as number of them was concerned, there being 11 that decreased and 10 that increased. But the four principal producing States, Pennsylvania, Illinois, West Virginia, and Ohio, each showed increased production by machines, and these four States are also the leaders in regard to the machine-mined tonnage in the following order: Pennsylvania, Ohio, Illinois, and West Virginia. These four States produce over 80 per cent of the total machine-mined product and about 70 per cent of the total coal output of the country. It is probable that the apparent decrease in the machine-mined product of some of the States is due to the failure of operators to reply definitely to these inquiries. The most notable decreases in regard to the use of machinery in 1901 were shown in Colorado and New Mexico. In Colorado the number of machines in use decreased from 90 to 62, and of the 62 machines in use some were operated only a short time during the year. The machine-mined product in Colorado fell off more than 50 per cent, from 756,025 tons in 1900 to 319,678 tons in 1901. In New Mexico the number of machines in use was reduced from 21 to 6, and the machine-mined tonnage from 112,000 to 2,700. A decrease from 81 machines in 1900 to 70 machines in 1901 is shown in the statistics for Montana, and the machine-mined tonnage shows a decline of 39 per cent, from 1,045,115 tons in 1900 to 748,981 tons in 1901. These three States are all included in the Rocky Mountain region.

Notwithstanding the decreased production by machines in the State of Montana, the State continues to hold the record for the percentage of the total product mined by machines. In 1901 Montana's machine-mined product was equivalent to 53.64 per cent of its total, as compared with 62.89 per cent in 1900. Ohio continues in second place in this respect, with 47.26 per cent of the total in 1901, as compared with 46.53 per cent in 1900. Kentucky remains in third place, with 41.21 per cent in 1901, as compared with 43.91 per cent in 1900. Pennsylvania, Indiana, Illinois, West Virginia, and Wyoming follow in the order named.

The statistics regarding the machine-mined tonnage of Illinois were obtained from the State bureau of labor statistics. The statistics as shown in the following tables, with the exception of Illinois, have been compiled from the reports to the Geological Survey by the operators. They show that in 1901 there were 4,341 machines in use at one time or another during the year, as compared with 3,907 in 1900 and 3,125 in 1899. The total amount of coal mined by machines in 1901 was 57,843,335 short tons, as compared with 52,784,523 short tons in 1900 and 43,963,935 short tons in 1899. In the ten years from 1891 to 1901 the number of machines in use has increased from 545 to 4,341, and the machine-mined product from 6,211,732 short tons to 57,843,335 short tons. The number of machines in use in 1901 was nearly eight times that of 1891, while the machine-mined tonnage was nearly nine times that of ten years before.

The statistics in regard to the production of coal by machines in the years for which they have been obtained are presented in the following tables, which show the number of machines in use, the number of tons mined by machines, the total production of the States in which machines were used, and the percentage of the machine-mined product of the total:

Bituminous coal mined by machines in the United States in 1891, 1896, 1897, 1898, 1899, 1900, and 1901.

State.	Number of machines in use.						
	1891.	1896.	1897.	1898.	1899.	1900.	1901.
Alabama	....	....	45	37	53	54	82
Alaska	....	6	6	(a)	(a)	(a)	....
Arkansas	....	14	15	21	16	20	20
Colorado	20	34	37	43	63	90	62
Illinois	241	307	320	392	440	430	464
Indiana	47	186	174	233	247	251	256
Indian Territory	....	56	54	75	74	58	47
Iowa	9	45	49	56	41	40	53
Kansas	....	....	1	2	3	3	4
Kentucky	....	....	162	158	189	239	237
Maryland	....	....	....	....	8	10	15
Michigan	....	....	....	7	25	33	31

[a] Not reported.

Bituminous coal mined by machines in the United States in 1891, etc.—Continued.

State.	Number of machines in use.						
	1891.	1896.	1897.	1898.	1899.	1900.	1901.
Missouri	....	4	3	4	9	15	24
Montana	....	62	61	62	75	81	70
New Mexico	....	....	....	29	14	21	6
North Dakota	....	1	2	7	5	7	7
Ohio	114	209	224	245	278	341	376
Pennsylvania	72	454	690	1,085	1,343	1,786	2,058
Tennessee	....	....	8	19	22	18	21
Texas	....	....	5	5	....	....	8
Utah	....	1	....	....	....	....	13
Virginia	....	....	8	8	8	9	6
Washington	....	3	....	....	2	2	4
West Virginia	8	25	47	86	154	327	403
Wyoming	34	39	45	48	56	69	74
Total	545	1,446	1,956	2,622	3,125	3,907	[a] 4,341

State.	Number of tons mined by machines.						
	1891.	1896.	1897.	1898.	1899.	1900.	1901.
Alabama	....	....	294,384	298,170	260,444	370,150	289,051
Alaska	....	15,232	17,920	(*b*)	(*b*)	(*b*)	....
Arkansas	....	21,094	87,532	152,192	146,899	219,085	102,220
Colorado	284,646	318,172	352,400	225,646	527,115	756,025	319,678
Illinois	3,027,305	3,871,410	3,946,257	3,415,635	6,085,312	5,083,594	5,774,639
Indiana	212,830	964,378	1,023,361	1,414,342	1,713,125	1,774,045	1,852,058
Indian Territory	....	191,585	263,811	274,370	276,180	239,424	177,233
Iowa	41,540	84,556	181,209	218,852	124,721	132,757	110,980
Kansas	....	....	4,500	11,722	40,271	46,164	37,979
Kentucky	....	....	1,299,436	1,366,676	1,625,809	2,339,944	2,254,711
Maryland	....	....	....	....	16,545	138,014	177,724
Michigan	....	....	....	1,456	64,055	191,577	177,969
Missouri	....	47,827	59,692	52,864	55,154	110,036	153,879
Montana	....	579,414	720,345	681,613	843,710	1,045,115	748,981
New Mexico	....	....	....	163,849	260,773	112,000	2,700
North Dakota	....	15,000	20,000	65,030	38,066	33,965	43,574
Ohio	1,654,081	3,368,349	3,843,345	5,191,375	6,822,524	8,835,743	9,908,316
Pennsylvania	431,440	6,092,644	8,925,293	16,512,480	22,000,722	26,867,053	29,591,368
Tennessee	....	....	47,207	152,002	208,033	176,872	220,573
Texas	....	....	11,750	15,340	....	....	22,420
Utah	....	760	....	....	....	....	14,738
Virginia	....	....	323,649	244,170	265,000	231,269	233,275
Washington	....	3,920	....	....	14,640	10,000	6,500
West Virginia	205,784	430,944	673,523	1,323,929	1,881,125	3,418,377	4,817,943
Wyoming	354,106	419,647	555,526	631,431	693,712	653,314	804,826
Total	6,211,732	16,424,932	22,651,140	32,413,144	43,963,935	52,784,523	57,843,335

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[a] Includes 2,580 pick machines, 1,716 chain breast machines, and 45 long wall machines.

[b] Not reported.

Bituminous coal mined by machines in the United States in 1891, etc.—Continued.

State.	Total tonnage of States using mining machinery.						
	1891.	1896.	1897.	1898.	1899.	1900.	1901.
Alabama			5,893,770	6,535,283	7,593,416	8,394,275	9,099,052
Alaska		15,232	17,920	(a)	(a)		
Arkansas		675,374	856,190	1,205,479	843,554	1,477,945	1,816,136
Colorado	3,512,632	3,112,400	3,361,703	4,076,347	4,776,224	5,244,364	5,700,015
Illinois	15,660,698	19,786,626	20,072,758	18,599,299	24,439,019	25,767,981	27,331,552
Indiana	2,973,474	3,905,779	4,151,169	4,920,743	6,006,523	6,484,086	6,918,225
Indian Territory		1,366,646	1,336,380	1,381,466	1,537,427	1,922,298	2,421,781
Iowa	3,825,495	3,954,028	4,611,865	4,618,842	5,177,479	5,202,939	5,617,499
Kansas			3,054,012	3,406,555	3,852,267	4,467,870	4,900,528
Kentucky			3,602,097	3,887,908	4,607,255	5,328,964	5,469,986
Maryland					4,807,396	4,024,688	5,113,127
Michigan				315,722	624,708	849,475	1,241,241
Missouri		2,331,542	2,665,626	2,688,321	3,025,814	3,540,103	3,802,088
Montana		1,543,445	1,647,882	1,479,803	1,496,451	1,661,775	1,396,081
New Mexico				992,288	1,050,714	1,299,299	1,086,546
North Dakota		78,050	77,246	83,895	98,809	129,883	166,601
Ohio	12,868,683	12,875,202	12,196,942	14,516,867	16,500,270	18,988,150	20,943,807
Pennsylvania	42,788,490	49,557,453	54,417,974	65,165,133	74,150,175	79,842,326	82,305,946
Tennessee			2,888,849	3,022,896	3,330,659	3,708,562	3,633,290
Texas			639,341	686,734			1,107,953
Utah		418,627	521,560				1,322,614
Virginia			1,528,302	1,815,274	2,105,791	2,393,754	2,725,873
Washington		1,195,504			2,029,881	2,474,093	2,578,217
West Virginia	9,220,665	12,876,296	14,248,159	16,700,999	19,252,995	22,647,207	24,068,402
Wyoming	2,327,841	2,229,624	2,597,886	2,863,812	3,837,392	4,014,602	4,485,374
Total	93,177,978	115,921,828	140,387,631	158,963,666	191,144,219	209,864,639	225,251,934

State.	Percentage of total product mined by machines.						
	1891.	1896.	1897.	1898.	1899.	1900.	1901.
Alabama			4.99	4.56	3.43	4.41	3.17
Alaska		100.00	100.00	(a)	(a)		
Arkansas		3.12	10.22	12.63	17.41	14.82	5.62
Colorado	8.10	10.22	10.48	5.54	11.03	14.42	5.60
Illinois	19.33	19.57	19.66	18.36	24.90	19.73	21.12
Indiana	7.16	24.69	24.65	28.74	28.52	27.36	26.77
Indian Territory		14.02	19.74	19.86	17.96	12.46	7.31
Iowa	1.09	2.14	3.93	4.74	2.21	2.55	1.97
Kansas			.15	.34	1.04	1.03	.77
Kentucky			36.07	35.15	35.29	43.91	41.21
Maryland					.34	3.43	3.47
Michigan				.46	10.20	22.55	14.33
Missouri		2.56	2.24	1.97	1.80	3.11	4.04
Montana		37.51	43.71	16.06	56.38	62.89	53.64
New Mexico				16.51	24.81	8.62	.24
North Dakota		19.22	25.89	77.51	38.52	26.15	26.15
Ohio	12.85	26.16	31.51	35.76	41.35	46.53	47.26
Pennsylvania	1.01	12.29	16.40	25.34	29.67	33.65	35.95
Tennessee			1.63	5.03	6.04	4.77	6.07
Texas			1.84	2.23			2.02
Utah		.18					1.11
Virginia			21.18	13.45	23.06	9.66	8.55
Washington		.33			.72	.40	.25
West Virginia	2.23	3.35	4.73	7.93	9.27	15.09	20.01
Wyoming	15.21	18.82	21.38	22.05	18.07	16.27	17.94
Average	6.66	14.17	16.19	20.39	23.00	25.15	25.68

a Not reported.

MANUFACTURED FUEL.

Several attempts have been made in the United States to utilize the waste product from both the anthracite and bituminous mines and to improve the quality of lignite fuels by mixing them with tar, asphaltum, and petroleum residuum or some other binding material and compressing into briquettes, but up to the present time none of these enterprises has proved a commercial success. In the course of the preparation of the present report a careful inquiry was made as to the development of this industry in the United States. The chief reason for the failure of the few enterprises of this kind that have been started has been the cheapness and superior quality of raw fuels. The cost of the small coal when mixed with the binder, added to the wear and tear of the machinery, with the cost of operation, makes the total cost for the manufactured briquettes equal to, if not more than, run-of-mine or even screened coal. It will probably be a number of years, and the prices of raw coals will have to be much higher than they are at present, before the briquetting of fine coal, whether lignite, bituminous, or anthracite will prove a profitable enterprise in this country.

LABOR TROUBLES.

So long as coal mining in the United States continues to be an industry, we may expect to find some instances of labor disaffections. The year 1901, while not entirely free from strikes, was probably as free from them as any year within our recent history. Anthracite coal mining was practically uninterrupted by any labor troubles, and among the bituminous-producing States the only one in which the industry was particularly affected was Iowa, where 401 men were idle for an average of 40 days. Notwithstanding this loss, the average time made in the State was 218 working days for the 12,653 men employed. Nearly all of the strikes in the other States were of short duration, the greatest average length of time lost outside of Iowa being in New Mexico, where 766 men were idle for an average of 43 days, and in Colorado, where 1,527 men were idle for an average of 56 days. Altogether there were 290 mines in which the men were idle for any length of time because of strikes, as compared with 257 mines, exclusive of the anthracite, so affected in 1900, and 359 mines in 1899. The total number of men on strike in 1901 was 20,593, as compared with 31,980 bituminous miners on strike and about 100,000 anthracite men in 1900, and 45,000 bituminous men on strike in 1899. The total amount of time lost in 1901 was 733,802 days. Including the anthracite strikes in 1900, the total time lost was 4,878,102 working days, and in 1899, when there was no strike in the anthracite region, the total time lost was 2,124,154 days.

The statistics of labor troubles in the coal mines of the United States in 1900 and 1901, by States, are shown in the following tables:

Statistics of labor strikes in the coal mines of the United States in 1900.

State or Territory.	Number of mines reporting strikes.	Number of men on strike.	Total days lost.	Average number of days lost per man.
Alabama	6	1,056	50,620	48
Arkansas	2	47	5,040	107
Colorado	2	17	935	55
Illinois	34	3,909	134,433	34
Indiana	36	3,583	71,282	20
Indian Territory	3	110	31,100	283
Iowa	25	1,322	62,333	47
Kansas	4	157	3,590	23
Kentucky	29	2,946	90,095	31
Maryland	22	4,787	504,544	105
Michigan	2	81	1,514	19
Missouri	14	632	34,970	55
Montana	1	40	1,640	41
Ohio	34	2,035	45,547	22
Pennsylvania bituminous	56	7,574	223,093	29
Tennessee	13	1,559	67,308	43
Texas	2	135	2,740	20
Washington	1	100	3,000	30
West Virginia	12	1,883	44,318	24
Total	298	31,973	1,378,102	43
Pennsylvania anthracite (approximate)	....	100,000	3,500,000	35

Statistics of labor strikes in the coal mines of the United States in 1901.

State or Territory.	Number of mines reporting strikes.	Number of men on strike.	Total days lost.	Average number of days lost per man.
Alabama	9	1,170	14,071	12
Colorado	14	1,527	86,045	56
Illinois	74	3,740	79,245	21
Indiana	17	1,027	40,812	39
Iowa	8	401	16,171	40
Kansas	2	60	300	5
Kentucky	11	933	32,707	35
Missouri	16	1,042	31,318	30
Montana	3	285	14,175	49
New Mexico	7	766	32,949	43
North Dakota	1	32	224	7
Ohio	30	2,724	105,177	38
Pennsylvania	28	2,541	125,116	49
Tennessee	14	1,705	82,730	49
Texas	1	113	226	2
Utah	3	754	23,055	30
Virginia	2	175	3,200	18
West Virginia	16	1,438	45,161	31
Wyoming	1	160	1,120	7
Total	257	20,593	733,802	35

IMPORTS AND EXPORTS.

The following tables have been compiled from official returns to the Bureau of Statistics of the Treasury Department, and show the imports and exports of coal from 1867 to 1899, inclusive. The values given in both cases are considerably higher than the average "spot" rates by which the values of the domestic production have been computed.

The tariff from 1824 to 1843 was 6 cents per bushel, or $1.68 per long ton; from 1843 to 1846, $1.75 per ton; 1846 to 1857, 30 per cent ad valorem; 1857 to 1861, 24 per cent ad valorem; 1861, bituminous and shale, $1 per ton; all other, 50 cents per ton; 1862 to 1864, bituminous and shale, $1.10 per ton; all other, 60 cents per ton; 1864 to 1872, bituminous and shale, $1.25 per ton; all other, 40 cents per ton. By the act of 1872 the tariff on bituminous coal and shale was made 75 cents per ton, and so continued until the act of August, 1894, changed it to 40 cents per ton. On slack or culm the tariff was made 40 cents per ton by the act of 1872; was changed to 30 cents per ton by the act of March, 1883, and so continued until the act of August, 1894, changed it to 15 cents per ton. The tariff act of 1897 provides that all coals which contain less than 92 per cent fixed carbon, and which will pass over a half-inch screen, shall pay a duty of 67 cents per ton. Slack or culm was not changed by the act of 1897. Tons are all 2,240 pounds. Anthracite coal has been free of duty since 1870. During the period from June, 1854, to March, 1866, the reciprocity treaty was in force, and coal from the British possessions in North America was admitted into the United States duty free.

The exports consist both of anthracite and bituminous coal, the amount of bituminous being the greater in the last few years. They are made principally by rail over the international bridges and by lake and sea to the Canadian provinces. Exports are also made by sea to the West Indies, to Central and South America, and elsewhere.

The imports are principally from Australia and British Columbia to San Francisco, from Great Britain to the Atlantic and Pacific coasts, and from Nova Scotia to Atlantic coast points.

The statistics of the exports for 1901 show that there was a considerable increase in the foreign trade in anthracite coal. The amount exported increased from 1,654,610 long tons in 1900, to 1,993,307 long tons in 1901, a gain of 338,697 tons, or nearly 20 per cent. This was largely due to the efforts made by the Philadelphia and Reading Coal and Iron Company to extend the foreign trade in anthracite coal. The enormous home demand for bituminous coal in 1901, added to the almost constant shortage of cars, caused a decided decrease in the export trade of that commodity. The amount of bituminous coal exported in 1901 was 5,390,086 long tons, a decrease of 872,823 long tons from the preceding year. This large decrease in bituminous exports is responsible for the decrease in the total exports of 534,126 long tons. The values were, however, so much enhanced by the conditions prevailing in 1901, that the total value of the exports increased nearly $500,000 over 1900.

The imports of anthracite coal are comparatively insignificant. A considerable increase has been shown in the last two years in the imports of bituminous coal, due to the establishment of the plant of Otto-Hoffman coke ovens by the New England Gas and Coke Company at Everett, Mass., the fuel for which is brought from the mines of Cape Breton, Nova Scotia. The amount of this fuel brought to the port of Boston in 1901 was 538,031 long tons, and was principally slack.

Coal of domestic production exported from the United States, 1867 to 1901.

Year ending—	Anthracite.		Bituminous and shale.	
	Quantity.	Value.	Quantity.	Value.
	Long tons.		*Long tons.*	
June 30, 1867	192,912	$1,333,457	92,189	$512,742
1868	192,291	1,082,745	86,367	433,475
1869	283,783	1,553,115	....	....
1870	121,098	803,135	106,820	503,223
1871	134,571	805,169	133,380	564,067
1872	259,567	1,375,342	141,311	586,264
1873	342,180	1,827,822	242,453	1,086,253
1874	401,912	2,236,084	361,490	1,587,666
1875	316,157	1,791,626	203,189	828,943
1876	337,934	1,869,434	230,144	850,711
1877	418,791	1,891,351	321,665	1,024,711
1878	319,477	1,606,843	340,661	1,352,624
1879	386,916	1,427,886	276,000	891,512
1880	392,626	1,362,901	222,634	695,179
1881	462,208	2,091,928	191,038	739,532
1882	553,742	2,589,887	314,320	1,102,898
1883	557,813	2,648,033	463,051	1,593,214
1884	649,040	3,053,550	646,265	1,977 959
1885	588,461	2,586,421	683,481	1,989,541
Dec. 31, 1886	667,076	2,718,143	544,768	1,440,631
1887	825,486	3,469,166	706,364	2,001,966
1888	969,542	4,325,126	860,462	2,529,472
1889	857,632	3,636,347	935,151	2,783,592
1890	794,335	3,272,697	1,280,930	4,004,995
1891	861,251	3,577,610	1,615,869	5,104,850
1892	851,639	3,722,903	1,645,869	4,999,289
1893	1,333,287	6,241,007	2,324,591	6,009,801
1894	1,440,625	6,359,021	2,195,716	4,970,270
1895	1,470,710	5,937,130	2,211,983	4,816,847
1896	1,350,000	5,925,506	2,276,202	5,072,818
1897	1,298,768	5,836,730	2,399,263	5,326,761
1898	1,350,948	5,712,985	3,152,459	6,699,248
1899	1,707,796	7,140,100	4,044,354	8,573,276
1900	1,654,610	7,092,489	6,262,909	14,431,590
1901	1,993,307	8,937,147	5,390,086	13,085,763

Coal imported and entered for consumption in the United States, 1867 to 1901.

Year ending—	Anthracite.		Bituminous and shale.	
	Quantity.	Value.	Quantity.	Value.
	Long tons.		*Long tons.*	
June 30, 1867	....	....	509,802	$1,412,597
1868	....	....	394,021	1,250,513
1869	....	....	437,228	1,222,119
1870	....	....	415,729	1,103,965
1871	973	$4,177	430,508	1,121,914
1872	390	1,322	485,063	1,279,686
1873	2,221	10,764	460,028	1,548,208
1874	471	3,224	492,063	1,937,274
1875	138	963	436,714	1,791,601
1876	1,428	8,560	400,632	1,592,846
1877	630	2,220	495,816	1,782,941
1878	158	518	572,846	1,929,660
1879	488	721	486,501	1,716,209
1880	8	40	471,818	1,588,312
1881	1,207	2,628	652,963	1,988,199
1882	36	148	795,722	2,141,373
1883	507	1,172	645,924	3,013,555
1884	1,448	4,404	748,995	2,494,228
1885	4,976	15,848	768,477	2,548,432
Dec. 31, 1886	2,039	4,920	811,657	2,501,153
1887	14,181	42,983	819,242	2,609,311
1888	24,093	68,710	1,085,647	3,728,060
1889	20,652	117,434	1,001,374	3,425,347
1890	15,145	46,695	819,971	2,822,216
1891	37,607	112,722	1,363,313	4,561,105
1892	65,058	197,583	1,143,304	3,744,862
1893	53,768	148,112	1,082,993	3,623,892
1894	90,068	234,024	1,242,714	3,785,513
1895	141,337	328,705	1,212,023	3,626,623
1896	101,689	237,717	1,211,448	3,453,742
1897	24,534	59,222	1,276,135	3,424,833
1898	3,149	8,609	1,277,070	3,569,743
1899	61	245	1,400,461	3,882,430
1900	118	549	1,909,258	5,019,553
1901	286	1,844	1,919,962	5,291,429

WORLD'S PRODUCTION OF COAL.

The three great coal-producing countries of the world are (1) the United States, (2) Great Britain, and (3) Germany. The output of these three countries combined make up 81.61 per cent of the world's total. Austria-Hungary, which comes fourth, has an output of only a little more than one-fourth of that of Germany, and a little more than one-seventh of the production of the United States. France is fifth, Belgium sixth, and Russia seventh. The last country, notwithstanding its vast area, produces only about 6 per cent as much coal as the United States. The three countries which lead in the production of coal are the three countries that lead in industrial development. Prior to 1899 Great Britain led among the world's coal producers, but in 1899, 1900, and 1901 the United States has made such remarkable increases in coal production, due principally to the unprecedented activity in the iron and steel and in other metal trades that we now stand far in the lead of all competitors, with a production in 1901 exceeding that of Great Britain by 47,965,938 short tons, or 19 per cent. Up to the close of 1900 the coal production of Great Britain and her colonies, if taken together, still exceeded that of the United States, but the enormous output of the coal mines of this country last year exceeded by about 25,550,000 short tons the entire output of Great Britain and her dependencies, including India and the Transvaal.

In the following table is given the coal production of the principal countries of the world for the years nearest the one under review for which the statistics could be obtained. The amounts are stated first in the unit of measurement adopted in each country, and then, for purposes of comparison, in short tons of 2,000 pounds, which is the standard unit for this report:

The world's production of coal.

Country.	Usual unit in producing country.	Equivalent in short tons.
United States (1901)....long tons	261,873,675	293,298,516
Great Britain (1901)....do	219,046,945	245,332,578
Germany (1901)....metric tons	152,628,931	168,217,082
Austria-Hungary (1900)....do	39,029,729	43,010,761
France (1901)....do	32,301,757	35,596,536
Belgium (1900)....do	23,462,817	25,856,024
Russia (1900)....do	16,151,557	17,799,016
Canada (1901)....short tons	6,186,286	6,186,286
Japan (1900)....metric tons	7,429,457	8,187,262
India (1900)....long tons	6,118.692	6,852,935
New South Wales (1900)....do	5,507,497	6,168,397
Spain (1901)....metric tons	2,747,724	3.027,992
New Zealand (1900)....long tons	1,093,990	1,225,269
Sweden (1900)....metric tons	252,320	278,057
Italy (1900)....do	480,859	529,907
Holland (1900)....do	320,225	352,888
South African Republic (1901)....long tons	752,116	671,532
Queensland (1900)....do	497,132	556,788
Victoria (1900)....do	211,596	236,988
Natal (1900)....do	241,330	270,290
Cape Colony (1900)....do	198,451	222,265
Tasmania (1900)....do	43,010	48,171
Other countries[a]....do	2,000,000	2,240,000
Total	....	866,165,540
Percentage of the United States	....	34

[a] Includes China, Turkey, Servia, Portugal, United States of Colombia, Chile, Borneo and Labuan, Mexico, Peru, Greece, etc.

In connection with the preceding statement the following tables are presented, in which the world's production of coal by countries in each year since 1868 is given for all countries for which statistics are available. This table shows that in 1868 the United States contributed only 14.35 per cent of the world's total. In 1901 the United States produced 34 per cent, the advance being practically regular during the intervening period. In 1868 the United States was exceeded as a coal producer by Germany as well as Great Britain, and it was not until 1877 that the United States permanently supplanted Germany as second among the world's producers. As already stated, the United States took first place among the coal producers of the world in 1899, and this lead has been so far increased during the last two years that this country may now be considered as firmly established as the leading coal-producing country of the world. The steps by which the United States has advanced to its present high position are graphically presented in the following table:

World's production of coal, by countries, since 1868.

Year.	United States.		Great Britain.		Germany.	
	Long tons.	Short tons.	Long tons.	Short tons.	Metric tons.	Short tons.
1868	28,258,000	31,648,960	103,141,157	115,518,096	32,879,123	36,249,233
1869	28,268,000	31,660,160	107,427,557	120,318,864	31,343,913	37,864,164
1870	32,863,000	36,806,560	110,431,192	123,682,935	34,003,004	37,488,312
1871	41,384,000	46,350,080	117,352,028	131,434,271	37,856,110	41,736,361
1872	45,416,000	50,865,920	123,497,316	138,316,994	42,324,467	46,662,725
1873	51,004,000	57,124,480	128,680,131	144,121,747	46,145,194	50,875,076
1874	46,916,000	52,545,920	126,590,108	141,780,921	46,658,115	51,440,605
1875	46,686,000	52,288,320	133,306,485	149,303,263	47,804,054	52,703,970
1876	47,500,000	53,200,000	134,125,166	150,220,186	49,550,461	54,629,383
1877	53,948,000	60,421,760	134,179,968	150,281,564	48,229,882	53,173,415
1878	51,655,000	57,853,600	132,612,063	148,525,511	50,519,899	55,698,188
1879	59,333,000	66,452,960	133,720,393	149,766,840	53,470,716	58,951,464
1880	63,822,830	71,481,569	146,969,409	164,605,738	59,118,035	65,177,634
1881	76,865,357	85,881,030	154,184,300	172,686,416	61,540,485	67,848,385
1882	92,219,454	103,285,789	156,499,977	175,279,974	65,378,211	72,079,478
1883	102,867,969	115,212,125	163,737,327	183,385,806	70,442,648	77,663,019
1884	106,906,295	119,735,051	160,757,779	180,048,712	72,113,820	79,505,487
1885	99,069,216	110,957,522	159,351,418	178,473,588	73,675,515	81,227,255
1886	101,500,024	113,680,027	157,518,482	176,420,700	73,682,584	81,235,049
1887	116,651,974	130,650,211	162,119,812	181,574,189	76,232,618	84,046,461
1888	132,731,613	148,659,407	169,935,219	190,327,445	81,960,083	90,360,992
1889	126,097,869	141,229,613	176,916,724	198,146,731	84,973,230	93,640,500
1890	140,866,931	157,770,963	181,614,288	203,408,003	89,290,834	98,898,500
1891	150,505,954	168,566,668	185,479,126	207,736,621	94,252,278	103,913,136
1892	160,115,242	179,329,071	181,786,871	203,601,296	92,544,050	102,029,815
1893	162,814,977	182,352,774	167,325,795	184,044,890	95,426,153	105,207,334
1894	152,447,791	170,741,526	188,277,525	210,870,828	98,805,702	108,883,884
1895	172,426,366	193,117,530	189,661,362	212,320,725	103,957,639	114,561,318
1896	171,416,390	191,986,357	195,361,260	218,804,611	112,471,106	123,943,159
1897	178,769,344	200,221,665	202,129,931	226,385,523	120,474,485	132,762,882
1898	196,405,953	219,974,667	202,054,516	226,301,058	130,928,490	144,283,196
1899	226,553,564	253,739,992	220,094,781	246,506,155	135,824,427	149,719,766
1900	240,788,238	269,682,827	225,181,300	252,203,056	149,551,000	164,805,202
1901	261,873,675	293,298,516	219,046,945	245,332,578	152,628,931	168,217,082

World's production of coal, by countries, since 1868—Continued.

Year.	Austria-Hungary.		France.		Belgium.	
	Metric tons.	Short tons.	Metric tons.	Short tons.	Metric tons.	Short tons.
1868	7,021,756	7,741,486	13,330,826	14,697,236	12,298,589	13,559,194
1869	7,663,043	8,448,505	13,509,745	14,894,494	12,943,994	14,270,753
1870	8,355,945	9,212,429	13,179,788	14,530,716	13,697,118	15,101,073
1871	8,437,401	9,302,235	13,240,135	14,597,249	13,733,176	15,140,827
1872	8,825,896	9,730,550	16,100,773	17,751,102	15,658,948	17,263,990
1873	10,104,769	11,140,508	17,479,341	19,270,973	15,778,401	17,395,687
1874	12,631,364	13,926,079	16,907,913	18,640,974	14,669,029	16,172,604
1875	13,062,738	14,395,137	16,956,840	18,694,916	15,011,331	16,549,992
1876	13,000,000	14,327,300	17,101,448	18,854,346	14,329,578	15,798,360
1877	13,500,000	14,883,750	16,804,529	18,526,993	13,669,077	15,070,157
1878	13,900,000	15,324,750	16,960,916	18,699,410	14,899,175	16,426,340
1879	14,500,000	15,986,250	17,110,979	18,864,854	15,447,292	17,030,640
1880	14.800,000	16,317,000	19,361,564	21,346,124	16,886,698	18,617,585
1881	15,304,813	16,873,556	19,765,983	21,791,996	16,873,951	18,603,531
1882	15,555,292	17,149,709	20,603,704	22,715,584	17,590,989	19,394,065
1883	17,047,961	18,795,377	21,333,884	23,520,607	18,177,754	20,040,974
1884	18,000,000	19,845,000	20,023,514	22,075,924	18,051,499	19,901,778
1885	20,435,463	22,530,098	19,510,530	21,510,359	17,437,603	19,224,957
1886	20,779,441	22,909,334	19,909,894	21,950,658	17,285,543	19,057,311
1887	21,879,172	24,121,787	21,287,589	23,469,567	18,378,624	20,262,433
1888	23,859,608	26,305,218	22,602,894	24,919,691	19,218,481	21,188,375
1889	25,328,417	27,924,580	24,303,509	26,794,619	19,869,980	21,906,653
1890	27,504,032	30,323,195	26,083,118	28,756,638	20,365,960	22,453,471
1891	28,823,240	31,777,622	26,024,893	28,692,444	19,675,644	21,692,398
1892	29,037,978	32,014,371	26,178,701	28,862,018	19,583,173	21,590,448
1893	30,449,304	33,570,358	25,650,981	28,280,207	19.410,519	21,400,097
1894	31,492,000	34,704,184	27,459,137	30,273,699	20,458,827	22,555,857
1895	32,654,777	35,985,564	28,019,893	30,877,922	20,450,604	22,536,566
1896	33,676,411	37,111,405	29,189,900	32,167,270	21,252,370	23,420,112
1897	35,858,000	39,515,516	30,797,629	33,938,987	21,534,629	23,731,161
1898	37,786,963	41,652,569	32,356,104	35,656,426	22,075,093	24,326,752
1899	38,739,000	42,690,378	32,863,000	36,215,026	21,917,740	24,159,925
1900	39,029,729	43,010,761	33,404,298	36,811,536	23,462,817	25,856,024
1901	....	(a)	32,301,757	35,596,536	....	(a)

[a] Latest available figures are used in making up totals.

World's production of coal, by countries, since 1868—Continued.

Year.	Russia.		Japan.		Other countries.	Total.	Per cent of United States.
	Metric tons.	Short tons.	Metric tons.	Short tons.	Short tons.	Short tons.	
1868....	430,032	473,895	....	....	1,147,330	221,035,430	14.32
1869....	579,419	638,510	....	....	1,104,563	229,200,013	13.81
1870....	667,806	735,922	....	....	1,063,121	238,621.068	15.42
1871....	772,371	851,153	....	....	1,114,248	260,526,424	17.79
1872....	1,037,611	1,143,447	....	....	1,268,115	283,002,843	17.97
1873...	1,154,618	1,272,389	....	....	1,502,516	302,703,376	18.87
1874....	1,270,889	1,400,520	....	....	2,708,756	298,616,379	17.60
1875....	1,673,753	1,844,475	....	....	2,639,104	308,419,177	16.95
1876....	1,795,146	1,968,251	....	....	2,597,143	311,594,969	17.07
1877....	1,760,276	1,939,824	....	....	2,821,155	317,118,648	19.05
1878....	2,483,575	2,738,141	....	....	3,176,050	318,441,990	18.17
1879....	2,874,790	3,169,456	....	....	3,362,605	333,585,069	19.92
1880....	3,238,470	3.570.413	....	....	3,621,342	364,737,405	19.60
1881....	3,439,787	3,792,365	....	....	5,185,974	392,663,253	21.87
1882....	3,672,782	4,049,242	....	....	6,128,631	420,082,472	24.58
1883....	3,916,105	4,317,506	1,021,000	1,125,142	6,929,841	450,990,397	25.55
1884....	3,869,689	4,266,332	1,159,000	1,277,218	7,367,309	454,022,811	26.37
1885....	4,207,905	4,639,215	1,314,000	1,448,028	7,570,507	447,581,529	24.79
1886....	4,506,027	4,967,895	1,402,000	1,545,004	9,082,815	450,848,793	25.22
1887....	4,464,174	4,921,752	1,785,000	1,967,070	10,399,273	481,412,743	27.14
1888....	5,187,312	5,719,011	2,044,000	2,252,488	11,493,176	521,225,803	28.52
1889....	6,215,577	6,852,674	2.435,000	2,683,370	12,618,299	531,797,039	26.56
1890....	6,016,525	6,633,219	2,653,000	2,923,606	13,025,637	563,693,232	27.99
1891....	6,233,020	6,871,905	3,230,000	3,559,460	14,744,329	587,554,583	28.69
1892....	6,816,323	7,514,996	3,228,000	3,557,256	14,998,633	593,497,904	30.22
1893....	7,535,000	8,307,337	3,350,000	3,691,700	15,783,599	582,638,296	31.30
1894....	8,629,000	9,509,158	4,311,000	4,750,722	18,197,510	610,487,368	27.97
1895....	9,079,138	10,005,210	4,849,000	5,343,598	19,428,643	644,177,076	29.98
1896....	9,229,000	10,170,358	5,019,690	5,531,698	20,866,748	664,001,718	28.92
1897....	11,207,475	12,350,638	5,647,751	6,225,516	22,074,093	697,205,981	28.75
1898....	12,307,450	13,562,810	6,761,301	7,572,657	24,797,873	738,128,008	29.80
1899....	13,562,810	15,730,346	6,716,831	7,401.948	25,811,285	801,974,821	31.64
1900....	16,151,557	17,799,016	7,429,457	8,187,262	[b] 27,684,964	846,040,648	31.89
1901....	....	(a)	....	(a)	[b] 28,867,765	[a] 866,165,540	33.86

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[a] Latest available figures are used in making up totals for 1899 and 1900.

[b] This includes, in addition to the countries named on the following pages, the output of Holland, 352,888 tons; Natal, 270,290 tons; Cape Colony, 222,265 tons; Tasmania, 48,171 tons; China, Turkey, Servia, Portugal, etc. (estimated), 2,240,000 tons. Total, 3,133,614 tons.

Production of minor coal-producing countries since 1868.

Year.	New South Wales.		Queensland.		New Zealand.	
	Long tons.	Short tons.	Long tons.	Short tons.	Long tons.	Short tons.
1868	954, 231	1, 068, 739	19, 611	21, 964	....	....
1869	919, 774	1, 030, 147	11, 120	12, 454	....	....
1870	868, 564	972, 791	22, 639	25, 356	....	....
1871	898, 784	1, 006, 638	17, 000	19, 040	....	....
1872	1, 012, 426	1, 133, 917	27, 727	31, 054	....	....
1873	1, 192, 862	1, 336, 005	33, 613	37, 647	....	....
1874	1, 304, 567	1, 461, 115	43, 443	48, 656	....	....
1875	1, 329, 729	1, 489, 296	32, 107	35, 960	....	....
1876	1, 319, 918	1, 478, 308	50, 627	56, 702	....	....
1877	1, 444, 271	1, 617, 584	60, 918	68, 228	....	....
1878	1, 575, 497	1, 764, 556	52, 580	58, 890	162, 218	181, 684
1879	1, 583, 381	1, 773, 387	55, 012	61, 613	231, 218	258, 964
1880	1, 466, 180	1, 642, 122	58, 052	65, 018	299, 623	335, 913
1881	1, 769, 597	1, 981, 949	65, 612	73, 485	337, 262	377, 733
1882	2, 109, 282	2, 362, 396	74, 436	83, 368	378, 272	423, 665
1883	2, 521, 457	2, 824, 032	104, 750	117, 320	421, 764	472, 376
1884	2, 749, 109	3, 079, 002	120, 727	135, 214	480, 831	538, 531
1885	2, 878, 863	3, 224, 327	209, 698	234, 862	511, 063	572, 390
1886	2, 830, 175	3, 169, 796	228, 656	256, 094	534, 353	598, 475
1887	2, 922, 497	3, 273, 197	238, 813	267, 470	558, 620	625, 654
1888	3, 203, 444	3, 587, 857	311, 412	348, 781	613, 895	687, 562
1889	3, 655, 632	4, 094, 308	265, 507	297, 368	586, 445	656, 818
1890	3, 060, 876	3, 428, 181	338, 344	378, 945	637, 397	713, 885
1891	4, 037, 929	4, 522, 480	271, 603	304, 195	668, 794	749, 049
1892	3, 780, 968	4, 234, 684	265, 086	296, 896	673, 315	754, 113
1893	3, 278, 328	3, 671, 727	264, 403	296, 131	691, 548	774, 534
1894	3, 672, 076	4, 112, 725	270, 705	303, 190	719, 546	805, 892
1895	3, 737, 536	4, 186, 040	322, 977	361, 734	727, 000	814, 240
1896	3, 909, 517	4, 378, 659	371, 000	415, 520	793, 000	888, 160
1897	4, 383, 591	4, 909, 622	358, 407	401, 416	840, 713	941, 600
1898	4, 736, 000	5, 304, 320	407, 819	456, 757	906, 778	1, 015, 591
1899	4, 597, 028	5, 148, 671	494, 009	553, 290	975, 234	1, 092, 262
1900	5, 507, 497	6, 168, 397	497, 132	556, 788	1, 093, 990	1, 225, 269
1901	....	(*a*)	....	(*a*)	....	(*a*)

a Latest available figures are used in making up totals.

Production of minor coal-producing countries since 1868—Continued.

Year.	Victoria.		Canada.	India.		Spain.	
	Long tons.	Short tons.	Short tons.	Long tons.	Short tons.	Metric tons.	Short tons.
1868	...	...	...	...	...	...	...
1869	...	...	...	...	...	...	...
1870	...	...	...	...	...	...	...
1871	...	...	...	...	...	...	...
1872	...	...	...	...	...	...	...
1873	...	...	...	...	...	...	...
1874	...	...	1,058,446	...	...	...	...
1875	...	...	984,905	...	...	...	...
1876	...	...	933,803	...	...	...	...
1877	...	...	1,002,395	...	...	...	...
1878	...	...	1,034,081	...	...	...	...
1879	...	...	1,123,863	...	...	...	...
1880	...	...	1,424,635	...	...	...	...
1881	...	...	1,487,182	997,543	1,117,248	...	...
1882	...	...	1,811,708	1,130,242	1,265,871	...	...
1883	...	...	1,806,259	1,315,976	1,473,893	...	...
1884	...	...	1,950,080	1,266,312	1,418,269	...	...
1885	...	...	1,879,470	1,294,221	1,449,528	...	...
1886	...	...	2,091,976	1,401,295	1,569,450	1,001,432	1,104,079
1887	...	...	2,418,494	1,560,393	1,747,640	1,038,305	1,144,731
1888	...	...	2,658,134	1,802,876	2,019,221	1,036,565	1,142,813
1889	14,421	16,152	2,719,478	2,045,359	2,290,802	1,153,755	1,272,015
1890	20,750	23,240	3,117,661	2,168,521	2,438,744	1,212,089	1,336,328
1891	22,834	25,574	3,623,076	2,328,577	2,608,006	1,287,988	1,420,007
1892	23,363	26,166	3,292,547	2,537,696	2,842,220	1,461,196	1,610,969
1893	91,726	102,733	3,201,742	2,529,855	2,833,438	1,484,794	1,636,986
1894	175,175	196,196	3,903,913	2,810,929	3,158,240	1,657,010	1,830,853
1895	194,171	217,472	3,512,504	3,538,000	3,962,560	1,783,783	1,965,729
1896	227,000	255,240	3,743,234	3,848,000	4,309,760	1,878,399	2,069,996
1897	236,277	264,630	3,786,107	4,063,127	4,550,702	1,939,400	2,137,219
1898	245,659	275,138	4,172,655	4,203,199	4,707,582	2,526,600	2,784,313
1899	262,380	293,866	4,925,051	5,093,260	5,704,451	2,742,389	3,022,113
1900	211,596	236,988	5,322,197	6,118,692	6,852,935	2,674,105	2,946,864
1901	...	(a)	6,186,286	...	(a)	2,747,724	3,027,992

[a] Latest available figures are used in making up totals.

Production of minor coal-producing countries since 1868—Continued.

Year.	Italy.		Sweden.		South African Republic.	
	Metric tons.	Short tons.	Metric tons.	Short tons.	Long tons.	Short tons.
1868	51,386	56,627				
1869	56,201	61,962				
1870	58,770	64,794				
1871	80,336	88,570				
1872	93,555	103,144				
1873	116,884	128,864				
1874	127,473	140,539				
1875	116,955	128,943				
1876	116,399	128,330				
1877	120,588	132,948				
1878	124,117	136,839				
1879	131,318	144,778				
1880	139,369	153,654				
1881	134,582	148,377				
1882	164,737	181,623				
1883	214,121	235,961				
1884	223,322	246,213				
1885	190,413	209,930				
1886	243,325	268,266				
1887	327,665	361,251				
1888	366,794	404,390				
1889	390,320	432,533				
1890	376,326	415,500	187,512	206,132		
1891	289,286	318,938	198,033	218,331		
1892	295,713	326,024	199,380	219,816		
1893	317,249	349,767	199,933	220,426	548,534	614,358
1894	271,395	299,103	213,633	235,532	791,358	886,321
1895	305,321	336,563	223,652	246,464	1,133,466	1,269,482
1896	276,197	304,369	226,000	249,052	1,437,297	1,609,772
1897	314,222	346,273	224,343	251,264	1,600,212	1,792,237
1898	341,327	376,245	236,277	260,448	1,907,271	2,136,143
1899	388,534	428,164	239,344	263,757	1,640,035	1,464,317
1900	480,859	529,907	252,320	278,057	486,022	433,948
1901		(a)		(a)	752,116	671,532

[a] Latest available figures are used in making up totals.

COAL-TRADE REVIEW.

The history of the coal-mining industry of the United States in 1901 was the most notable on record. Not only was it a year of almost uninterrupted activity in the mines, which resulted in an output eclipsing all previous records, but the good prices attained in 1900 were continued. In the case of the anthracite production the percentage of increase was considerably larger than that of bituminous coal, and the average price of hard coal was a little over 10 per cent higher in 1901 than in 1900. In addition to these satisfactory conditions so far as production is concerned, the year 1901 was a season more than usually free from labor disturbances, the number of men on strike and the number of days lost being considerably less than for several years. It is to be regretted that at the time of writing this report (June, 1902) the anthracite coal-mining industry is entirely paralyzed by a strike affecting the entire region, and that in some of the bituminous districts the peaceful conditions which existed in 1901 have been succeeded by struggles between employers and employees.

As has been pointed out in previous reports, the markets for anthracite coal are becoming more and more restricted, notwithstanding the largely increased production of anthracite coal in 1901 as compared with 1900. The strike which occurred in the anthracite mines in September and October of 1900 reduced the production of anthracite coal in that year over 2,700,000 long tons. Under ordinary circumstances the production of anthracite coal in 1900 should have amounted to about 55,000,000 long tons, compared with which the production in 1901 would have shown an increase of approximately 5,000,000 tons, which would have been a normal rate of increase. Although the production of anthracite coal in 1901 was the largest on record, and notwithstanding the fact that there has been a general increasing tendency in anthracite production, its rate of increase has not kept pace with that of bituminous coal or with other of our great mining and manufacturing industries.

The growth of the bituminous coal-mining industry, as compared with that of anthracite, is particularly noticeable. In order to illustrate this the following table has been prepared in which the output of anthracite and bituminous coal is shown in 1880, the average by five-year periods from 1881 to 1900, and the total production in 1901. This table shows that the average production in the five years from 1881 to 1885 was about 7,500,000 tons more than that of 1880. The average annual production from 1886 to 1890 was 6,000,000 tons more than that for the five years previous. The average for the next five years shows an increase of over 11,250,000 tons, but in the period from 1896 to 1900 the increase is only a little more than 2,200,000 tons. Comparing this with increase in bituminous production shows that in 1880 the total amount of bituminous coal mined was about one and one-half times that of the anthracite. The average production from 1881 to 1885 was nearly double that of anthracite, and from 1886 to 1890 it was two and one-fourth times the anthracite production. In the period from 1896 to 1900 the bituminous production was more than three times that of anthracite, and in 1901 the production of bituminous coal was about three and one-third times that of anthracite.

Comparative increases in the production of anthracite and bituminous coal.

[Short tons.]

Period.	Anthracite.	Bituminous.
1880	28,649,811	42,831,758
1881–85	36,194,188	70,816,115
1886–90	42,151,364	94,488,681
1891–95	53,405,189	125,216,327
1896–1900	55,625,165	171,495,837
1901	67,471,667	225,826,849

In the following pages will be found interesting reviews of the coal trade in some of the principal cities of the United States. These reviews have been contributed by secretaries of boards of trade or of chambers of commerce, or by other competent authorities. They show in each city increased activity in 1901, as compared with the preceding year. From these special reviews and from those in preceding volumes of this series the following summary has been prepared:

Coal receipts at important centers.

	1897.	1898.	1899.	1900.	1901.	Increase, 1901.	Decrease, 1901.
Philadelphia (long tons):							
Anthracite	5,193,898	4,981,697	5,423,045	5,179,438	6,091,907	912,469	....
Bituminous	4,608,092	5,156,602	5,314,460	6,807,634	6,337,542	....	470,092
Boston (long tons) [a]							
Anthracite	1,981,119	1,866,877	2,226,094	2,005,879	2,163,558	157,679	....
Bituminous	1,656,919	1,768,442	1,841,394	2,150,551	2,110,830	....	39,721
Pittsburg (short tons) [b]	15,887,345	18,467,086	20,075,066	20,718,537	23,001,126	2,382,589	....
Cleveland (short tons):							
Anthracite	201,756	179,891	202,782	138,614	326,741	188,127	....
Bituminous	3,779,305	4,533,721	4,857,295	4,136,696	3,996,493	....	140,203
Toledo [b]	2,984,834	3,877,678	3,837,736	5,725,407	5,995,232	269,825	....
Chicago (short tons):							
Anthracite	1,776,400	1,840,858	2,146,554	1,572,019	2,192,545	620,526	....
Bituminous	5,373,852	4,976,779	6,463,506	6,956,622	6,635,892	....	320.730
Milwaukee (short tons):							
Anthracite	645,432	768,150	922,321	639,100	845,687	206,587	....
Bituminous	910,376	920,911	997,543	1,169,493	1,107,802	....	61,691
St. Louis (short tons):							
Anthracite	172,933	225,616	292,118	180,550	200,797	20,247	
Bituminous	3,349,239	3,342,498	4,124,629	4,172,706	4,754,431	581,725	....
Cincinnati (short tons):							
Anthracite	50,050	37,925	51,650	17,500	48,775	31,275	....
Bituminous	3,100,431	3,319,793	3,100,011	2,905,021	3,202,560	297,539	....

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[a] Not including foreign (mostly Nova Scotian) coal imported, which amounted to 538,031 long tons in 1901, 551,817 tons in 1900, and 201,671 in 1898. Prior to 1898 such receipts were insignificant.

[b] Anthracite and bituminous.

NEW YORK CITY.

The following review of the coal trade of New York City has been prepared by Mr. Samuel Sanford:

The year 1901 will ever be memorable in the history of the anthracite trade. Demand was very heavy, the output in no less than four months exceeding all previous monthly records, and the total for the year reaching 60,242,560 long tons, 6,297,913 tons in excess of the 1899 output of 53,944,647 long tons, the largest to that date. The great output, however, was not the most noteworthy feature of the year. The high level of prices, even during the months of so-called midsummer dullness, was the incident of greatest moment. The heavy demand for coal was in part responsible for the high prices received, or rather the demand was an important factor in carrying through successfully a plan of marketing coal devised by the financial interests that controlled over 60 per cent of the amount of coal shipped from the mines. Under this plan, which was made public about April 1, a schedule of prices was fixed to go into effect on September 1. Under this schedule the prices of free-burning white ash coal free on board New York harbor shipping ports was to be as follows: Broken size, $4; egg, $4.25; stove and chestnut, $4.50. The steam sizes, pea, buckwheat, and rice, were not covered by this agreement, but the various producers were to market these sizes on the best terms obtainable to stimulate buying during the dull months of the year and insure a more liberal output at the mines during those months, thus minimizing what had long been an objectionable feature of the anthracite trade—a partial suspension of work at the mines for four months or longer. Graded discounts were made of 50 cents per ton in April, 40 cents in May, 30 cents in June, and so on until schedule figures were reached on September 1. No sales for future delivery were to be allowed at discount figures. Only such coal as was delivered during any month was to get the benefit of that month's discount. In connection with this plan—one of the wisest ever devised in the history of the trade—the various companies undertook the reform of another abuse. Prices were made the same to all dealers, large and small, thus doing away with what had been a most prolific source of price cutting—the special rates given certain firms of middlemen—besides insuring more uniform prices to all consumers. The net result of these reforms was a large increase in buying during late spring and early summer, an entire absence of any such cut-throat competition as had demoralized the trade in previous years, and somewhat higher prices. As is known to all persons familiar with the history of the anthracite trade, though the various producing companies in previous years had made plans and agreements to put the trade on a substantial basis, the companies usually failed to live up to such agreements. In fact, few enterprises in this country can show such a history of mismanagement as the mining, transportation, and marketing of anthracite coal. The success of the reforms mentioned above means profits for companies on the edge of bankruptcy, steadier employment for mine employees, and uniform, if higher, prices to consumers.

The total amount of anthracite consumed in the limits of Greater New York yearly is probably close to 7,000,000 tons. The exact amount is not easily determined. At first sight it appears an easy task to take the amount shipped by the anthracite carrying roads and deduct from the total shipments the amount sent forward by barges and schooners from the New York harbor ports. As a matter of fact, however, a considerable amount of the coal brought to tide water is taken by dealers in New York City and sent to points up Long Island Sound or elsewhere, but it appears on the books of the railroads as sold for New York delivery. There are other factors which complicate the problem, but the total tonnage used in Greater New York last year was not far from 7,000,000 tons.

The tonnage sold in New York in 1901 was probably the largest on record, notwithstanding that the use of gas and coke as fuel for domestic purposes during the summer months has increased decidedly during late years. Buying was well distributed through the year, probably better than ever before, largely owing to the plan adopted by the large companies of selling at fixed prices for the current month, as before described. It may be said that New York dealers had a stronger feeling that the new system was likely to be maintained than those at some other points and bought liberally at the April and May discounts. Dealers at New York, however, owing to the high price of land, while the shipping docks are near, as a rule have very small storage yards in proportion to the business they do. Consequently they have not been accustomed to buy largely in excess of current needs.

The year opened with anthracite in demand, the market not having recovered from the effects of the 1900 strike, and trade was more active than in thirty years. The regular prices quoted for free-burning white ash coal free on board New York harbor ports were: Broken, $4; egg, $4.25; stove and chestnut, $4.50; pea, $3. During January the quotations on broken and egg sizes declined a little, being at the opening of February $3.65 for broken and $4 for egg. February was a cold and stormy month, as was March, and the demand for coal continued strong, with prices unchanged. Consequently market conditions were favorable to a good spring trade. The new spring price lists that appeared in April received much attention and brought out considerable early buying. These prices for free-burning white coal free on board New York harbor shipping ports were: Broken, $3.50; egg, $3.75; stove and chestnut, $4. Prices were to be advanced 10 cents monthly till basis prices were reached in September. A fear of the general strike of the miners in May also influenced April buying, which was usually good throughout the month. May saw business still good, many dealers not having been able to secure all the coal they wanted at April prices. Stocks in the hands of producers were less on May 31 than on May 1, a most unusual occurrence. The market during June was probably more active at other points than at New York, yet sales agents here reported business good for the time of year. Those dealers who had doubted the stability of the new selling plan began to realize that the market was not likely to see such a demoralization as had prevailed during the summer in former years. A strike of mine firemen affected shipments from the Lackawanna and Wyoming regions during the latter part of July. The market during July and August remained quiet but strong. With prices back to full-list figures in September, and the most critical period in the year safely passed, the market became stronger, though trade at New York harbor ports was quiet. In October the short car supply, first felt by bituminous producers, began to affect the anthracite trade, and in November was a decided factor in the market. Demand at New York harbor ports was good during October and strong in November. In December a heavy rain storm early in the month did much damage. Mines were flooded, and numerous washouts along the railroads almost stopped shipments to New York harbor ports for nearly two weeks. The year closed with the demand for anthracite very heavy. Prices remained at September figures: Broken, $4; egg, $4.25; stove and chestnut, $4.50.

To sum up, it may be said that the favorable showing of the anthracite trade during 1901 was due to three causes: (1) The general prosperity of the country for several years and the resulting increased purchasing power of the people; (2) the cold weather in February and March, which insured a strong spring market; and (3) the new selling system adopted by the large companies, which brought out early buying and prevented the market from becoming demoralized during the dull summer months.

The bituminous coal used in New York and vicinity last year amounted probably to about 5,000,000 to 6,000,000 tons. It came from Pennsylvania, Maryland, Virginia, and West Virginia. It was shipped to tide water over four railroads: The Norfolk and Western, carrying the product of the Pocahontas and Flat Top fields in southwest Virginia and southeast West Virginia, to Norfolk; the Chesapeake and Ohio taking the output of the New River fields to Newport News; the Baltimore and Ohio shipping from the mines in the Piedmont and Cumberland districts in West Virginia and Maryland to Baltimore; and the Pennsylvania system, which carried to Philadelphia and South Amboy the coal from the Clearfield and the Huntington and

Broad Top fields in Pennsylvania and the Cumberland region in Maryland. Stockholders in the Pennsylvania Railroad have acquired what is practically a controlling interest in the other three lines, and a system adopted last year distributes the output of the mines to the markets most readily available. This arrangement reduces selling agencies and shortens rail haul. In general, it must be said, that the arrangement has worked satisfactorily. Freight rates were higher than during the previous years, but the market has been free from the demoralizing influence of a large tonnage of coal dumped on it, and producers enjoyed the benefits of this steadying influence. The year opened with trade at New York in fairly good shape. The better grades of coal, such as Pocahontas and Georges Creek, were in demand, while Clearfield and lower grades sold slowly, but by the end of the January the supply of even the higher grades was plentiful. Clearfield sold at $2.40 and $2.65, free on board New York harbor shipping ports, with the higher grades at $2.85 and over. Throughout February, coal accumulated at tide water. Ice hindered shipments at New York harbor and at the lower ports, but had no particular effect on prices, and by the end of the month some lots of low-grade coal on which demurrage had accrued, sold as low as $2.10, free on board New York harbor shipping ports. The Bituminous Coal Trade Association held several sessions in New York City in March. Owing to the accumulation of coal at tide water, all producers cut their output sharply. Rumors of possible strikes at the mines, particularly in Pennsylvania, brought out some speculative buying, but the market remained dull. Late in the month, when most firms who make yearly contracts were closing for the new year's supply, producers announced that they would extend old prices for the coming year. Those for New York harbor shipping ports were as follows: Georges Creek and other high-grade Maryland and West Virginia coals, $2.85 free on board, Clearfield, $2.65. Trade during April remained dull. The poor grades were in abundant supply, while the higher grades were firmly held. The railroads put embargoes on shipments to keep coal from accumulating at tide water and restricted the power supply to such producers as allowed coal to accumulate. This condition continued through May and June and found the tide-water shipping ports still congested with cars awaiting vessels. By the end of June, however, conditions began to improve, though prices showed little change. Clearfield at the beginning of July sold for $2.35, free on board New York harbor shipping ports, with the higher grades at $2.85. During July the market for the better grades of coal remained firm, the producers refusing to sell at less than the regular price. The poorer grades, however, were in plentiful supply and sold at discounts. By the middle of August demand had revived and continued to improve during September, though the lower-grade coals were still in oversupply. By the middle of October trade at New York harbor ports had improved considerably. The short car supply, however, was now felt by the producers, and by the middle of the month was less than 50 per cent of the total demands of the mines. It varied from 25 per cent to 50 per cent of the demand during the remainder of the year. During November and December the demand at New York harbor ports became pressing and all grades sold at full prices. By the end of the year consumers were regularly paying $3.50 a ton for coal at the New York harbor shipping ports, and the coal thus obtained was very often of very poor quality. In some cases concerns in the bunker trade, owing to the large export movement in grain and other commodities from New York, and the impossibility of getting adequate supplies, owing to the car shortage, paid as much as $4 for spot coal.

A noticeable feature of the year which, however, affected the trade at points along Long Island Sound and east of Cape Cod more than at New York harbor, was the remarkable evenness of the freight rates for coastwise transportation in barges and schooners. The year opened with the low prices of the previous summer still in force, and did not advance until November, when, within a few weeks, rates rose more than 25 cents a ton. Floats and small barges distribute the coal received at South Amboy and St. George to New York harbor docks and those at the nearer Long Island Sound ports. Some coal from the lower Chesapeake Bay ports comes to New York in barges.

BOSTON, MASS.

The following review of the coal trade of Boston has been prepared by Mr. Elwyn G. Preston, secretary Boston Chamber of Commerce.

The gross receipts of coal at the port of Boston during 1901 exceeded those of the previous year, which was the largest year on record, by 104,172 long tons. This increase does not, however, represent the growth of the coal trade in this section, as owing to close traffic arrangements via the Boston and Maine system a larger share of this business than heretofore has been brought into New England by rail.

The following table shows the receipts for the past eighteen years:

Receipts of coal at Boston for eighteen years.

[Long tons.]

Year.	Domestic.				Foreign.	Total.
	By water.		All rail.			
	Anthracite.	Bituminous.	Anthracite.	Bituminous.		
1884						2,225,740
1885						2,221,220
1886					44,464	2,500,000
1887					13,966	2,400,000
1888	2,057,279	1,004,195			10,081	3,071,555
1889	1,647,348	914,966			5,538	2,567,852
1890	1,740,564	964,857			14,072	2,719,493
1891	2,039,443	1,070,088			5,842	3,115,373
1892	2,163,984	919,815			1,416	3,085,215
1893	2,227,086	1,100,384		[a]50,000	17,097	3,394,567
1894	2,237,599	958,701		[a]71,303	41,779	3,309,382
1895	2,518,441	977,762		[a]90,999	21,009	3,608,211
1896	2,092,798	1,391,949		[a]104,080	61,071	3,649,898
1897	1,948,283	1,591,245	32,836	65,674	50,235	3,688,273
1898	1,835,806	1,706,929	31,071	62,143	17,122	3,653,071
1899	2,178,791	1,746,780	47,303	94,614	201,671	4,269,159
1900	1,973,733	2,086,260	32,146	64,291	551,817	4,708,247
1901	2,139,989	2,063,691	23 569	47,139	538,031	4,812,419

[a] Total anthracite and bituminous.

The amount of coal received at Boston by water and forwarded to interior New England points during 1901 aggregated 333,178 long tons of anthracite and 792,225 tons bituminous, a total of 1,125,403 tons. Deducting this amount from the gross receipts at Boston, the amount retained for local consumption is shown to be—

Anthracite	1,830,380 long tons, an increase of 221,918 tons.
Bituminous	1,856,636 tons, an increase of 5,600 tons.
Total	3,687,016 as compared with 3,459,498 tons in 1900, an increase of 7 per cent.

The figures of the amount of coal coming into New England that has been diverted from water routes to all-rail routes during the past year is difficult of exact calculation, but it seems clear that there has been a diversion in this direction of several hundred thousand tons. The following table shows the receipts at Boston for consumption, by months, during 1901:

Monthly receipts of coal at Boston for 1901, with comparisons.

[Long tons.]

Month.	Receipts, all routes.		Amount forwarded to interior New England points.		Net receipts (for local consumption).	
	Anthracite.	Bituminous.	Anthracite.	Bituminous.	Anthracite.	Bituminous.
January	162,940	205,791	27,620	64,904	135,320	140,887
February	148,737	239,155	30,216	53,086	118,521	186,069
March	190,917	235,113	36,568	57,643	154,349	177,470
April	150,850	216,214	40,673	41,246	110,177	174,968
May	227,118	195,396	39,008	60,603	188,110	134,793
June	238,181	271,416	29,897	60,210	208,284	211,206
July	162,757	186,886	27,459	77,864	135,298	109,022
August	199,477	215,893	22,769	77,286	176,708	138,607
September	176,233	219,977	23,941	66,737	152,292	153,240
October	206,674	232,956	19,219	107,885	187,455	125,071
November	159,991	226,210	20,992	56,697	138,999	169,513
December	139,683	203,854	14,816	68,064	124,867	135,790
Totals, 1901.	2,163,558	[a]2,648,861	333,178	792,225	1,830,380	1,856,636
Totals, 1900.	2,005,879	[b]2,702,368	397,417	851,332	1,608,462	1,851,036
Totals, 1899.	2,226,094	[c]2,043.065	461,827	647,533	1,764,267	1,395,532
Totals, 1898.	1,866,877	1,786,194	368,960	663,008	1,497,917	1,123,186
Totals, 1897.	1,981,119	1,707,154	418,171	734,541	1,562,948	972,613

[a] Includes 538,031 tons foreign coal, chiefly from Cape Breton.

[b] Includes 551,817 tons foreign coal.

[c] Includes 201,671 tons foreign coal. Prior to 1899 imports of foreign coal were unimportant.

The factor in the coal situation during the past year has been the ocean rates. Prices at Philadelphia and Baltimore have remained practically without change during the year, and the price of coal in this market has been substantially an established shipping price, plus ocean freight, insurance, and discharging charges. The scarcity of cars in the shipping section and the delays incident to getting the coal to tide water resulted in a premium being demanded for shipments from certain ports at times during the year, and later caused the introduction into most charter parties of provisions requiring the loading to be accomplished within a certain specified number of days, usually five or six. This trouble and the especially high rates occurred principally during the closing months of the year. The following table shows the range of ocean rates during the year, and the months during which the extreme prices occurred:

Coal freights to Boston.

From—	Minimum.	Maximum.
Philadelphia	$0.70 to $0.75, Apr. to Oct.	$1.15 to $1.25, Dec.
Baltimore	.75 to .80, Apr. to Aug.	1.25 to 1.30, Dec.
Norfolk and Newport News	.70, May to July.	1.05 to 1.10, Dec.
New York	.50 to .65, May	.70 to .80, Jan.

The above prices represent quotations current throughout the year, but individual charters were made at prices somewhat above the extreme range.

Prices in the local market averaged considerably lower than the previous year, which was an abnormal one for both hard and soft coal. The anthracite market covered a range from $5.50 to $6.50, the low price covering quotations for the months of April to August, inclusive. During the first three months of the year the established price for anthracite coal was $6.25 per ton, the midsummer level of $5.50 being reached the second week in April. The latter part of August local dealers adjusted their differences and agreed upon an advance of 50 cents per ton to $6, which was maintained until the middle of October, when a further advance of 50 cents was made. The labor controversy, by means of which the teamsters engaged in the coal and other trades received an advance equal to about $1 per week wages, was said to be the immediate occasion of the October advance of 50 cents per ton, which was maintained the remainder of the year.

Georges Creek Cumberland coal nominally ranged from $3.45 to $4.05 per ton, free on board cars at tide water, that range representing practically the difference in carriers' rates at different times throughout the year. As a matter of fact, the best quality of soft coal brought at times as high as $4.75 and $5 per ton, in a few isolated instances even higher prices when there was a scarcity at Boston. As was the case the previous year, the shortage and the consequent higher prices of the best grades stimulated the sale of the cheaper grades of steam coal.

The receipts of foreign coal were substantially the same as those of the previous year, aggregating 538,031 tons, as compared with 551,817 tons in 1900.

The New England Gas and Coke Company, whose works are located in a suburb of Boston, continue to supply a considerable quantity of coke for domestic uses and for certain manufacturing plants. A very large percentage of the product of these works, however, is used by the Boston and Maine and other railroads for their passenger locomotives, which restricts the amount available for the general market in competition with the ordinary steam or house coal.

PHILADELPHIA, PA.

The following review of the coal trade of Philadelphia has been prepared by Mr. Samuel R. Kirkpatrick, railroad editor of the Philadelphia Press:

There was an increase in the consumption of both anthracite and bituminous coal in this city during the year 1901; but there was a slight decrease in the shipments of bituminous coal to points outside of the harbor and for export. The falling off in the export of soft coal is due in a great measure to the withdrawing of our war vessels from active service in southern waters. At the same time there was an increase in the export of anthracite coal. The total shipments of anthracite and bituminous coal amounted to 12,429,449 tons, as compared with 11,987,072 tons in 1900.

During the year 1901 there was little trouble experienced by the coal-producing companies, and the production was the largest in the history of anthracite mining. The demand for this fuel was greater than ever, and with the heavy movement of all kinds of freight and the large amount of construction work being done by the railroad companies, there was a great scarcity of cars and many of the companies had trouble to secure enough coal to fill their orders. For the first time in many years there was little cutting of prices indulged in. The circulars fixed by the companies were lived up to and it was only in exceptional cases that any concessions were made. In April the coal companies put into effect a new circular, which was an innovation. This circular fixed the prices on prepared sizes for the year, but begining with April there was a reduction of 50 cents a ton for that month, 40 cents for May, 30 cents for June, 20 cents for July, and 10 cents for August. In September the regular circular prices were charged, and for the remainder of the year there was no change. This is to be the policy of the coal companies in the future, to issue one circular a year, but during the time from April to September there is to be a reduction of 50 cents a ton for the first month, and 40 cents for the second, 30 cents for the third, 20 cents for the fourth, and 10 cents for the fifth month. In all other months the circular prices are to be enforced.

While there were no differences that amounted to trouble between the operators and miners, there were times when the bituminous operators were bare of coal, as they were unable to secure cars. Notwithstanding this, the consumption of bituminous coal in this city in 1901 amounted to 1,632,110 tons, as compared with 1,628,285 tons in 1900. In that year the mills and factories were working to their full capacity. The shipments to points outside of Philadelphia showed a slight falling off, which was due principally to the inability of the soft coal companies to secure the fuel to ship. The amount of coal sent outside of Philadelphia was 4,081,326 tons, as against 4,410,149 during the previous year. There was a falling off in the export trade of 105,651 tons, the decrease being entirely in bituminous coal.

An effort has been made by the Philadelphia and Reading Coal and Iron Company to build a market for the consumption of anthracite coal abroad. During the past year that company sent abroad nearly all the hard coal which was loaded for foreign ports. It is understood that owing to the lack of knowledge on the part of the foreigners there is considerable trouble experienced in introducing this coal, as the grates in the furnaces in Europe are not adapted to burning anthracite coal. The effort to secure a ready market for our anthracite coal abroad is to be continued. Contingent orders have been made for shipment during 1902, and it is thought that as soon as the people abroad can become accustomed to the use of hard coal that it will be more extensively used. The shipments of this coal abroad in 1901 amounted to 60,510 tons, as against 21,067 in the previous year.

The total amount of anthracite distributed in this city in 1901 was 6,091,907 tons, and of bituminous 6,337,542 tons. The bituminous trade was fairly good and at times the demand exceeded the supply. There was comparatively little cutting of prices and toward the close there was a general scarcity. In January the average price for Clearfield and Big Vein Cumberland was from $1 to $1.35. Until September the price fluctuated between 75 cents and $1.35 a ton, but in November there was a jump of from $1.10 to $2, and in December from $1.25 to $2.50. Georges Creek coal was steady the whole year around at $1.35 a ton.

The great demand for all kinds of fuel caused a general scarcity throughout the city. The local retail dealers had little coal on hand and the big demand prevented the coal companies from stocking their yards. Some of the large coal companies for the best part of the year had no stocks of coal on hand, and a hand-to-mouth policy was in vogue for almost the whole time. Notwithstanding the extraordinary demand and the scarcity of anthracite, there was no advance in the circular prices.

The anthracite coal companies are more closely united than ever, and, while it is said there is no trust, they work in harmony, and when one road sets an example the others follow. There has been little disposition shown to break away from the circular, owing in a great measure to the heavy demand for anthracite coal. Not for many years have the coal companies had as little coal on hand as they have now; and notwithstanding there were dull periods, no stock was accumulated during the year. The innovation by the companies to issue only one circular each year, but to make a reduction during the months of April, May, June, July, and August, caused a better demand during these months. Midsummer is generally a dull period in the anthracite-coal trade, as is also the case in the bituminous trade. The output of hard coal was heavier than ever before, and for several months over 5,000,000 tons were produced. Toward the close of the year the shortage of cars caused diminution of production, and while the output was large it would have amounted to considerably more if the carrying equipment could have been secured.

The bituminous trade was fairly well maintained, although shortly after the beginning of the year the production exceeded the demand and some cutting was indulged in. The local consumption for twelve months was 1,632,110 tons, a slight increase over the corresponding time in 1900, but there was a falling off in the export trade. Toward the middle of the year the trade began to steady, and in September higher prices were in order. Notwithstanding there was no strike in the anthracite coal regions, the soft coal operators held the gain made in the previous years.

The anthracite coal trade was exceedingly good, and the producing companies secured a good return for the money invested. The operators had little to contend with, as there was little trouble with the miners. The mines were run to their full capacity and the mine workers received more money in 1901 than ever before. Prosperity ruled throughout the anthracite coal region. There was a good demand for anthracite coal all over the country. Early in the year shipments to New England ports began, and as soon as navigation was opened on the Great Lakes, coal was sent to stock the storage yards in the far West. The demand in the East was, however, so great that the coal set aside for the West was diverted to near-by uses. At the close of the year the stocks in Boston, New York, Philadelphia, and other large cities were practically exhausted.

The price circular of the Philadelphia and Reading Coal and Iron Company, which is the same as the other companies, is as follows:

Circular prices for anthracite coal in Philadelphia during 1900 and 1901.

Size.	1900.		1901.				
	April.	October.	January.	April.	July.	September.	October.
Lump and steamboat	$2.50	$2.50	$2.50	$2.00	$2.30	$2.50	$2.50
Broken	2.25	2.75	2.75	2.25	2.55	2.75	2.75
Egg	2.40	3.00	3.00	2.50	2.80	3.00	3.00
Stove	2.65	3.25	3.25	2.75	3.05	3.25	3.25
Chestnut	2.65	3.25	3.25	2.75	3.05	3.25	3.25
Pea	1.50	1.75	1.75	1.50	1.50	1.75	1.75
Buckwheat	1.00	1.25	1.25	1.25	1.25	1.25	1.25

There were only two circulars issued to the city and line trade during the year, although the April circular was used as a basis for the reduction during the summer months. Until nearly the end of the year the middlemen derived the usual commissions, but toward the close of 1901 the Reading Company began to dispense with these agents and soon took hold of the business and made its own sales. The other coal companies continued to allow commissions.

The following table shows the actual selling prices of prepared sizes for years 1898, 1899, 1900, and 1901:

Selling prices of prepared anthracite coal at the mines for Philadelphia for four years.

[Per long ton.]

Month.	Sizes.	1898.	1899.	1900.	1901.
January	Broken	$2.00	$2.10	$2.35–$2.50	$2.25–$2.75
	Egg	2.40	2.15	2.85	3.00
	Stove	2.50	2.25	2.95	3.25
	Nut	2.30	2.25	2.95	3.25
	Pea		1.15	1.60– 1.75	1.60– 1.75
February	Broken	2.00	2.10	2.35– 2.50	2.25– 2.75
	Egg	2.40	2.15	2.85	3.00
	Stove	2.50	2.25	2.95	3.25
	Nut	2.30	2.25	2.95	3.25
	Pea		1.15	1.35– 1.75	1.60– 1.75
March	Broken	2.00	2.25	2.25– 2.50	2.25– 2.75
	Egg	2.40	2.40	2.85	3.00
	Stove	2.50	2.50	2.95	3.25
	Nut	2.30	2.50	2.95	3.25
	Pea		1.15	1.35– 1.75	1.60– 1.75
April	Broken	2.00	2.25	2.10– 2.35	2.25
	Egg	2.40	2.40	2.40	2.50
	Stove	2.50	2.50	2.65	2.75
	Nut	2.30	2.50	2.65	2.75
	Pea		1.15	1.35– 1.50	1.60
May	Broken	2.10	2.25	2.10– 2.35	2.25– 2.35
	Egg	2.15	2.40	2.40	2.60
	Stove	2.25	2.50	2.65	2.85
	Nut	2.10	2.50	2.65	2.85
	Pea		1.15	1.35– 1.50	1.60
June	Broken	2.10	2.25	2.10– 2.25	2.25– 2.45
	Egg	2.30	2.30	2.00– 2.40	2.70
	Stove	2.25	2.40	2.25– 2.50	2.95
	Nut	2.10	2.40	2.25– 2.50	2.95
	Pea		1.00	1.35– 1.50	1.60
July	Broken	2.10	2.15	2.00– 2.25	2.25– 2.55
	Egg	2.30	2.30	2.25– 2.75	2.80
	Stove	2.25	2.40	2.25– 2.75	3.05
	Nut	2.10	2.40	2.25– 2.75	3.05
	Pea		1.00	1.10– 1.50	1.60
August	Broken	2.00	2.25	2.00– 2.35	2.25– 2.65
	Egg	2.30	2.40	2.00– 2.50	2.90
	Stove	2.25	2.50	2.25– 2.75	3.15
	Nut	2.10	2.50	2.25– 2.75	3.15
	Pea		1.00	1.00– 1.50	1.60
September	Broken	2.00	2.25	2.10– 2.35	2.25– 2.75
	Egg	2.30	2.50	2.25– 2.50	2.75– 3.05
	Stove	2.25	2.60	2.50– 2.75	3.25
	Nut	2.10	2.60	2.50– 2.75	3.25
	Pea		1.00	1.00– 1.50	1.40– 1.60
October	Broken	2.00	2.25	2.50– 3.00	2.25– 2.75
	Egg	2.15	2.60	3.25– 3.75	2.75– 3.05
	Stove	2.25	2.70	3.25– 4.25	3.25
	Nut	2.10	2.70	3.25– 4.25	3.25
	Pea		1.00	2.25– 3.25	1.40– 1.60

Selling prices of prepared anthracite coal at the mines for Philadelphia for four years—Continued.

Month.	Sizes.	1898.	1899.	1900.	1901.
November	Broken	$2.00	$2.25	$2.75	$2.25-$2.75
	Egg	2.15	2.85	3.00	2.75- 3.05
	Stove	2.25	2.95	3.25	3.25
	Nut	2.10	2.95	3.25	3.25
	Pea	....	1.00	1.75- 2.00	1.40- 1.60
December	Broken	2.00	2.25	2.75	2.25- 2.75
	Egg	2.15	2.85	3.00	2.75- 3.05
	Stove	2.25	2.95	3.25	3.25
	Nut	2.10	2.95	3.25	3.25
	Pea	....	1.75	1.75- 2.00	1.40- 1.60

There was no change in freight rates for local delivery during the year. The charges per ton, which vary according to the region from which the shipment is made and according to size of coal, were as follows:

Freight rates on anthracite coal from regions to Philadelphia.

[Per long ton.]

Region.	Prepared sizes.	Pea.	Buckwheat.
Schuylkill	$1.70	$1.40	$1.25
Lehigh	1.75	1.45	1.30
Wyoming	1.80	1.50	1.35

The consumption of pea and buckwheat coal continues to increase, although there is a decrease in the use of pea coal for manufacturing purposes. Many plants are now burning buckwheat, while dwellings are using more pea size than ever before. This coal is cheaper than the other sizes and it is easy to handle. During the year the price of pea, buckwheat, and rice changed little. At times the demand was greater than the supply. In January, 1901, pea coal brought $1.60 to $1.75 a ton, buckwheat 75 cents to $1.25, and rice 20 to 45 cents. The latter coal sold at these figures for the rest of the year, while pea dropped to $1.40, and buckwheat to 75 cents, after it had risen to $1.10.

Through the courtesy of the officers of the Pennsylvania Railroad Company, the Philadelphia and Reading Railway Company, the Lehigh Coal and Navigation Company, and the Baltimore and Ohio Railroad Company, data have been furnished from which the following table has been compiled. It shows the distribution of coal at Philadelphia for the export trade, the coastwise and harbor trade, and the Philadelphia local trade. The figures of 1900 are also given for the purpose of comparison.

Distribution of coal at Philadelphia in 1900 and 1901.

[Long tons.]

Destination.	1900.		1901.	
	Anthracite.	Bituminous.	Anthracite.	Bituminous.
Export	21,067	769,200	60,510	624,106
Coastwise and harbor	1,653,805	4,410,149	2,006,791	4,081,326
Local	3,504,566	1,628,285	4,024,606	1,632,110
Total	5,179,438	6,807,634	6,091,907	6,337,542

NORFOLK, VA.

Col. William Lamb has furnished for this report the following statement in regard to the coal shipments from Lamberts Point piers, the shipping port for the Norfolk and Western Railroad.

Pocahontas coal shipments from Lamberts Point piers since 1891.

[Long tons.]

Year.	Foreign.	Bunkers.	Coastwise.	Local.	Total.
1891	27,997	135,112	1,215,028	90,606	1,468,743
1892	25,653	129,627	1,400,984	98,034	1,654,298
1893	34,969	125,688	1,512,931	100,453	1,774,041
1894	44,328	105,382	1,810,480	96,841	2,057,031
1895	34,174	75,714	1,430,144	100,442	1,640,474
1896	41,600	99,867	1,433,069	96,929	1,671,465
1897	44,103	104,966	1,473,710	115,079	1,737,858
1898	200,283	107,154	1,450,943	131,422	1,889,802
1899	207,649	125,920	1,497,297	131,916	1,962,782
1900	524,558	281,411	1,126,855	180,530	2,113,354
1901	542,658½	247,594½	1,125,024¼	182,307½	2,097,584

The receipts and shipments of Pocahontas coal for 1901 show a slight decrease in comparison with the previous year, most of which may be accounted for by the disastrous fire in the mines at Pocahontas, in which there was a sad loss of life, including some of the officials who headed a rescue party. There was a considerable decrease in bunker coal because of the extremely low freights and falling off in shipments from ports which usually sent their steamers to Lamberts Point for bunkers to cross the ocean. There was, however, a decided increase in foreign export business. Shipments were continued to nearly all the ports reported for the year 1900, and were also made to the following additional destinations: Australia, Barbados, Belgium, Germany, Hawaiian Islands, Newfoundland, Norway, Port Arthur (China), and Singapore, with largely increased shipments to Tampico and Vera Cruz, Mexico.

MOBILE, ALA.

Mr. Edward E. England, formerly secretary of the Chamber of Commerce, Mobile, Ala., has contributed the following review in regard to the coal trade of Mobile:

The coal receipts at Mobile are increasing annually, the receipts for the past year being a fraction under 400,000 tons. This increase, to some extent, is due to the increasing number of manufacturing enterprises, but the great bulk of the coal is for the use of steamers that come to this port. Mobile is the second largest city in the country in the value of exports to Cuba. In fact, the exports from Mobile to Cuba exceed the combined exports of all the other ports excepting that of New York. The two regular lines have about as much business as they can handle, and the consumption of coal by these lines is very large. The fruit companies have also increased their fleets, and Mobile has now an average of 34 steamers per month sailing to Central and South America and three steamship lines to Mexico. Mexico has also imported quite a lot of coal from Mobile during the past year, but the exportation has been cut short, because the demand upon the mines is greater than the output, although the production of Alabama mines is increasing as rapidly as the means of transportation will allow. The trans-Atlantic lines and the numerous tramp steamers that are and have been coming, increase the demand for coal at Mobile. As yet, the oil situation has had no appreciable effect on coal as a fuel, but will no doubt have during the coming year, as the fruit companies that own their steamers or have steamers under a long-time charter are now changing them as fast as they can to oil burners. The experiment in case of one steamer, the *Breakwater*, has demonstrated that the use of oil made a difference of forty-eight hours in her time to Central America and back, and that the saving per annum in the use of oil instead of coal amounted to nearly $10,000 for this one steamer alone.

PITTSBURG, PA.

The amount of coal mined, handled, and used in the city of Pittsburg and vicinity exceeds that of any other city in the United States, not excepting even New York, but unfortunately there is no local bureau devoted to the collection of the statistics regarding the trade of the city. The following table, which presents a statement of the amount of coal used and shipped through the city of Pittsburg, has been compiled from reports made to the Geological Survey by officials of the railroads entering Pittsburg, and by the United States Army officers in charge of the slack-water navigation of the Monongahela River and the improvements under way on the Ohio River below Pittsburg. The railroad officials furnishing the information for this report, and to whom special acknowledgments are due, are Mr. J. G. Searles, coal freight agent, Pennsylvania Railroad, Philadelphia, Pa.; Mr. W. L. Andrews, assistant coal and coke agent, Baltimore and Ohio Railroad, Pittsburg, Pa.; Mr. C. F. Perkins, coal freight agent, Pennsylvania lines west of Pittsburg, Pittsburg, Pa.; Mr. F. A. Dean, general freight agent, Pittsburg and Lake Erie Railroad, Pittsburg, Pa. The statistics for 1901, in regard to the coal movement by the Monongahela River locks and through the Davis Island dam on the Ohio River below Pittsburg, have been furnished by Capt. William L. Sibert, Corps of Engineers, United States Army.

As is shown in the following table, the total movement of coal to and through Pittsburg in 1901 was 23,001,126 short tons, as compared with 20,718,537 short tons in 1900 and 20,075,066 short tons in 1899. Of the total movement in 1901, 16,355,646 short tons, or 71 per cent, were received by rail, and 6,645,480 short tons, or 29 per cent, by water. Of the local consumption, which amounted to 9,430,828 short tons, 6,068,701 short tons, or 65 per cent, were received by rail, and 3,362,127 tons, or 35 per cent, by the Monongahela River. The shipments through Pittsburg, which were almost entirely to points west, aggregated 13,570,298 short tons, of which 10,286,945 tons, or 76 per cent, were shipped by rail, and 3,283,353 tons, or 24 per cent, went by water. The corresponding figures for 1900 were: Local consumption: Rail, 7,439,979 tons; river, 3,260,393 tons; total, 10,700,372 tons. Shipments through Pittsburg: Rail, 7,460.695 tons; river, 2,557,470 tons; total, 10,018,165 short tons.

The details of the movement of coal in the Pittsburg district since 1897 are shown in the following table:

Shipments of coal to and through Pittsburg in 1897, 1898, 1899, 1900, and 1901.

[Short tons.]

Transportation route.	1897.	1898.	1899.	1900.	1901.	Increase in 1901.	Decrease in 1901.
Pennsylvania R. R.:							
To Pittsburg and vicinity	1,379,718	1,328,540	1,698,240	1,792,448	2,051,361	258,913	....
To west of Pittsburg	1,206,598	1,283,052	1,459,546	1,477,277	1,407,643	....	69,634
Baltimore and Ohio R.R.:							
To Pittsburg district	395,265	430,139	546,679	481,587	464,204	....	17,383
To west of Pittsburg	581,851	656,345	950,632	990,082	1,157,966	167,884	....
Pittsburg, Cincinnati, Chicago, and St. Louis R. R. [a]	2,369,022	2,783,816	3,322,227	3,298,470	3,933,601	635,131	....
Allegheny Valley Rwy.: [a]							
To Pittsburg district	125,445	125,180	145,924	150,000	163,809	13,809	....
To west of Pittsburg	20,721	39,977	6,332	6,500	19,755	13,255	....
Pittsburg and Lake Erie R. R.:							
Local and Pittsburg	1,506,296	1,880,000	2,125,173	2,234,770	1,789,327	....	445,443
To west of Pittsburg	3,012,591	3,759,237	4,250,346	4,469,540	5,367,980	898,440	....

[a] Coal originating on this road only. Does not include coal received from the Pennsylvania Railroad and forwarded over the Allegheny Valley Railway.

Shipment of coal to and through Pittsburg in 1897, etc.—Continued.

[Short tons.]

Transportation route.	1897.	1898.	1899.	1900.	1901.	Increase in 1901.	Decrease in 1901.
Monongahela River locks:							
To Pittsburg district.	2,619,469	3,141,306	2,860,827	3,260,393	[b]3,362,127	101,734	....
To west of Pittsburg.	2,670,369	2,979,494	2,709,140	2,557,470	3,283,353	725,883	....
Total shipments.	15,887,345	18,407,086	20,075,066	20,718,537	[a]23,001,126	2,282,589	....
West of Pittsburg[b]	8,661,152	10,218,105	10,976,645	10,018,165	13,570,298	3,552,133	....
Local consumption	7,226,193	8,188,981	9,098,421	10,700,372	9,430,828	....	....

[a] In addition to this amount a considerable quantity of coal mined in pools Nos. 1 and 2 is consumed by works along the Monongahela River. Capt. William L. Sibert, U. S. A., estimates the amount so consumed in 1901 at 1,300,000 short tons.

[b] Shipments over the Pittsburg, Cincinnati, Chicago and St. Louis Railroad are separated in the same ratio as the totals of other lines. Total shipments only over this line were reported.

MONONGAHELA RIVER SHIPMENTS.

Capt. William L. Sibert, Corps of Engineers, United States Army, in charge of the improvements on the Monongahela and Ohio rivers, reports the tonnage passing through the locks of the Monongahela River in 1901 as 6,645,480 tons. Of this amount 3,283,353 tons passed through the Davis Island dam below Pittsburg, leaving as representing the local consumption 3,362,127 short tons. Captain Sibert calls attention, however, to the large consumption of coal in pools 1 and 2, which do not pass through the locks, and which should be added to the consumption of coal in Pittsburg and vicinity. This amount is estimated in 1901 at 1,300,000 tons, which would increase the Pittsburg consumption of river coal to about 4,660,000 tons. The movement of coal through Monongahela River locks and the Davis Island dam since 1890 is shown in the following table:

Movements of coal through Monongahela River locks and Davis Island dam.

[Short tons.]

Year.	Passed through locks on Monongahela River.	Passed Davis Island dam, Ohio River, near Pittsburg. (From annual reports, Ohio River improvement.)	Difference, approximate consumption of river coal at Pittsburg.
1890	4,652,104	3,420,357	1,231,747
1891	4,276,588	2,893,752	1,382,836
1892	3,872,340	2,299,291	1,573,046
1893	3,860,072	2,364,401	1,495,671
1894	4,649,612	2,453,787	2,195,825
1895	4,183,596	2,393,873	1,789,723
1896	5,709,252	4,102,190	1,607,062
1897	5,289,838	2,670,369	2,619,469
1898	6,120,800	2,979,494	3,141,306
1899	5,569,967	2,709,140	2,860,827
1900	5,817,863	2,557,470	3,260,393
1901	6,645,480	3,283,353	[a]3,362,127

[a] To this amount should be added about 1,300,000 short tons mined in pools Nos. 1 and 2 and consumed at works within the pools.

RECEIPTS AND SHIPMENTS BY RAIL.

The following tables show the receipts and shipments of coal by railroads entering the Pittsburg district:

Receipts of coal via Pennsylvania Railroad in 1897, 1898, 1899, 1900, and 1901.

[Short tons.]

To—	1897.	1898.	1899.	1900.	1901.
Pittsburg and vicinity	1,379,718	1,328,540	1,698,240	1,792,448	2,051,361
West of Pittsburg	1,206,598	1,283,052	1,459,546	1,477,277	1,407,643
Total	2,586,316	2,611,592	3,157,786	3,269,725	3,459,004

Shipments of coal over the Pittsburg, Cincinnati, Chicago and St. Louis Railroad.

[Short tons.]

Year.	Quantity.	Year.	Quantity.
1896	2,585,547	1899	3,322,227
1897	2,369,022	1900	3,298,470
1898	2,783,816	1901	3,933,601

Shipments of coal via Allegheny Valley Railway to and through Pittsburg.

[Short tons.]

Year.	Pittsburg district.	Via Pittsburg to all points.	Total.
1896	162,945	64,887	227,832
1897	125,445	20,721	146,166
1898	125,180	39,977	165,157
1899	145,924	6,332	152,256
1900[a]	150,000	6,500	156,500
1901	163,809	19,755	183,564

[a] Approximate.

Shipments of coal and coke via Baltimore and Ohio Railroad to and through Pittsburg.

[Short tons.]

Year.	Pittsburg district.		Via Pittsburg to all points.	
	Coal.	Coke.	Coal.	Coke.
1897	395,265	487,745	581,851	1,020,430
1898	430,139	437,343	656,345	1,610,759
1899	546,679	549,086	950,632	1,478,768
1900	481,587	578,731	999,082	1,641,767
1901	464,204	738,342	1,157,906	1,992,919

Shipments of coal over the Pittsburg and Lake Erie Railroad.

[Short tons.]

Year.	Quantity.	Year.	Quantity.
1896	4,573,072	1899	6,375,519
1897	4,518,887	1900	6,704,310
1898	5,639,237	1901	7,157,307

CLEVELAND, OHIO.

The following review of the coal trade of Cleveland has been prepared by Mr. F. A. Scott, secretary Chamber of Commerce:

The Cleveland local coal market for the year 1901 was, perhaps, more uniform in the way of demand and the price obtained than usual. A firm demand was experienced over the greater part of the year, easing only during the few hot months, May, June, and July. There was a very firm demand during the first four months of the year and an extraordinarily strong demand the latter part of the year.

There existed a great scarcity of cars during the fall of last year, perhaps greater than at any time in the past, many gondolas being taken from the coal business and being pressed into service for other classes of freight usually requiring box cars. Scarcity of cars and the strong demand created almost a famine in the months of September, October, and November, and while prices did not rule so high as they did in 1899 yet some fancy prices were paid in order to obtain coal for immediate consumption. Price on the whole for coal during the entire year was satisfactory to the mine owners. Labor troubles were confined to local districts and were generally settled without any great delay.

Coal and coke receipts and shipments at Cleveland since 1888.

RECEIPTS.

[Short tons.]

Kind.	1888.	1889.	1890.	1891.	1892.	1893.
Bituminous	1,737,781	1,600,000	1,560,208	2,838,586	3,651,080	3,603,984
Anthracite	181,551	160,000	205,856	201,927	259,150	262,266
Coke	124,827	150,000	194,527	189,640	351,527	235,248
Total	2,044,159	1,910,000	1,960,591	3,230,153	4,261,757	4,101,498

SHIPMENTS.

[Short tons.]

Anthracite by rail	29,735	25,000	29,056	34,910	50,742	49,497
Bituminous by rail	1,000,000	1,100,000	1,200,000	1,525,000	1,728,831	24,128
Bituminous by lake						1,257,326
Total	1,029,735	1,125,000	1,229,056	1,559,910	1,779,573	1,330,951

Coal and coke receipts and shipments at Cleveland since 1888—Continued.

RECEIPTS.

[Short tons.]

Kind.	1894.	1895.	1896.	1897.	1898.	1899.	1900.	1901.
Bituminous	2,715,540	2,842,333	2,994,802	3,779,305	4,533,721	4,857,295	4,136,696	3,996,493
Anthracite	207,604	201,022	142,832	201,756	179,891	202,782	138,614	326,741
Coke	298,061	432,216	338,678	503,935	482,539	484,738	394,934	601,213
Total	3,221,205	3,475,571	3,476,312	4,484,996	5,196,151	5,544,815	4,670,244	4,924,447

SHIPMENTS.

[Short tons.]

Anthracite by rail.	44,177	31,894	20,299	33,750	27,650	41,072	15,456	18,731
Bituminous by rail.	30,000	64,908	25,872	71,770	511,447	46,622	31,779	39,240
Bituminous by lake	1,106,000	1,125,624	1,803,709	2,027,693	2,108,310	2,171,417	2,201,828	1,787,028
Coke by rail	42,048	49,536	85,256	117,390	93,628	129,146	51,448	20,678
Total	1,222,225	1,271,962	1,935,136	2,250,603	2,741,035	2,388,257	2,300,511	1,865,677

Clearances of coal from the Cuyahoga (Ohio) district for fourteen years.

[Short tons.]

Year.	Quantity.	Year.	Quantity.
1888	1,855,260	1895	2,948,324
1889	2,020,996	1896	3,863,645
1890	2,328,663	1897	3,613,245
1891	2,635,461	1898	3,844,239
1892	2,957,988	1899	4,062,869
1893	3,052,342	1900	4,912,421
1894	2,239,829	1901	4,442,514

TOLEDO, OHIO.

In previous reports of this series, the statistics of coal receipts, etc., at Toledo have been obtained from the annual report of the Produce Exchange. The exchange decided not to issue any annual report covering 1901, as some of the railroads refused to furnish the figures of their shipments for publication. In the following table the statement regarding the total receipts at Toledo for 1901 has been furnished by Mr. A. Gassaway, secretary of the Produce Exchange. The receipts in 1901 amounted to 5,995,232 short tons, as compared with 5,725,407 tons in the preceding year. The receipts in 1901 were a little more than double the receipts for 1897, and three times those for 1895.

The total receipts at Toledo since 1896 have been as follows:

Total coal receipts at Toledo since 1886.

[Short tons.]

Year.	Quantity.	Year.	Quantity.
1886	2,340,859	1894	2,510,808
1887	2,695,713	1895	1,934,914
1888	3,524,785	1896	2,934,711
1889	2,840,314	1897	2,984,834
1890	3,021,886	1898	3,877,678
1891	2,754,943	1899	3,837,736
1892	2,291,355	1900	5,725,407
1893	3,445,995	1901	5,995,232

CHICAGO, ILL.

The following tables, which show the comparative receipts of coal at and shipments from Chicago, have been compiled by the Bureau of Coal Statistics of that city and published by the Black Diamond. The effects of the strike in the anthracite region of Pennsylvania in 1900 were shown in a decrease of nearly 575,000 tons in the receipts of anthracite in Chicago during that year, as compared with 1899. In 1901 the receipts of anthracite were 620,526 tons in excess of the receipts of 1900, and nearly 50,000 tons more than those of 1899. The receipts of bituminous coal both by lake and by rail in 1901 were less than in 1900. The combined receipts of anthracite and bituminous coal, however, in 1901, exceeded those of the preceding year by 299,796 tons.

Receipts of bituminous coal and coke at Chicago for five years.

[Short tons.]

State from which received.	1897.	1898.	1899.	1900.	1901.	Increase in 1901.	Decrease in 1901.
Pennsylvania	211,158	410,801	[a]516,087	564,833	525,571	....	39,262
Ohio	313,632	240,592	550,157	547,425	492,701	....	54,724
West Virginia and Kentucky	649,441	475,738	805,122	973,982	1,024,979	50,997	....
Illinois	2,628,384	2,275,118	2,618,309	2,662,986	2,427,092	....	235,894
Indiana	1,571,237	1,574,530	1,973,831	2,207,396	2,165,549	....	41,847
Total bituminous coal	5,373,852	4,976,779	6,463,506	6,956,622	6,635,892	....	320,730
Coke	527,608	928,893	520,558	613,842	594,686	....	19,156

[a] Receipts by lake, included in this amount, were 75,277 tons.

Receipts of anthracite coal at Chicago in 1900 and 1901.

[Short tons.]

Month.	Anthracite by lake.		Anthracite by rail.		Total anthracite.		Increase in 1901.	Decrease in 1901.
	1901.	1900.	1901.	1900.	1901.	1900.		
January			157,510	82,852	157,510	82,852	74,658	
February			152,216	53,274	152,216	53,274	98,942	
March			95,469	54,371	95,469	54,371	41,098	
April		26,613	55,275	17,640	55,275	44,253	11,022	
May	112,942	190,729	78,793	15,151	191,735	205,880		14,145
June	98,866	128,521	64,206	72,074	163,072	200,595		37,523
July	83,957	125,890	72,928	70,362	156,885	196,252		39,367
August	119,053	159,989	78,151	66,138	197,204	226,127		28,923
September	166,152	115,879	85,649	59,138	251,801	175,017	76,784	
October	209,143	28,605	154,139	9,216	363,282	37,821	325,461	
November	136,937	72,626	82,439	32,528	219,376	105,154	114,222	
December	109,536	69,263	79,184	121,160	188,720	190,423		1,703
Total	1,036,586	918,115	1,155,959	653,904	2,192,545	1,572,019	620,526	

MILWAUKEE, WIS.

The following review of the coal trade of Milwaukee has been furnished by Mr. William J. Langson, secretary of the Chamber of Commerce, in advance of the publication of his own report to that office:

Milwaukee has become the leading port of distribution on Lake Michigan for anthracite or hard coal, the receipts of which during the past season show an increase of 206,587 tons over the amount received in 1900.

The total receipts of hard and soft coal together for the year 1901 were the largest recorded, amounting to 1,953,489 short tons, or 46,511 tons less than two millions, which was the quantity the writer expected the receipts of the year to reach. Unless restricted by labor troubles the receipts of the present year are likely to exceed that amount.

There was a decided scarcity of soft coal during the past year owing to the miners' strike of 1900.

The shipments of coal from Milwaukee westward by rail during the year amounted to 776,650 short tons, showing that the local consumption was approximately 1,176,839 tons, against an indicated local consumption the preceding year of 1,134,121 tons. The stocks on hand at the docks of this city on the opening of navigation this year, as well as the preceding one, were nearly exhausted.

The coal docks of Milwaukee as equipped at the present time can readily handle 3,000,000 tons annually, and the work is practically all done by machinery and steam power.

The total receipts of anthracite and bituminous coal at Milwaukee since 1896 have been as follows:

Total receipts of coal at Milwaukee, Wis., for six years.

Kind.	1896.	1897.	1898.	1899.	1900.	1901.
	Short tons.	*Short tons.*	*Short tons.*	*Short tons.*	*Short tons.*	*Short tons.*
Anthracite	813,487	645,432	768,150	922,321	639,100	845,687
Bituminous	774,308	910,376	920,911	997,543	1,169,493	1,107,802
Total	1,587,795	1,555,808	1,689,061	1,919,864	1,808,593	1,953,489

A comparison of the receipts of coal at Milwaukee, by decades, with those of 1901 is interesting, and is shown in the following table:

Growth of the coal trade of Milwaukee.

Year.	Receipts.
	Short tons.
1868	92,992
1878	239,667
1888	1,122,243
1898	1,689,061
1901	1,953,489

The tables following exhibit the details of receipts and shipments at Milwaukee for a series of years:

Receipts of coal at Milwaukee for seven years.

Source.	1895.	1896.	1897.	1898.	1899.	1900.	1901.
By lake from—	*Short tons.*	*Short tons.*	*Short tons.*	*Short tons.*	*Short tons.*	*Short tons.*	*Short tons.*
Buffalo	755,831	745,870	545,219	624,616	797,006	515,545	717,356
Erie	86,332	19,879	92,370	134,774	273,779	222,789	259,841
Oswego	33,364	60,309	38,319	37,000	2,590	1,257	2,365
Cleveland	105,469	232,689	305,435	341,898	354,900	277,786	191,785
Ashtabula	99,521	114,625	132,103	115,579	94,284	149,208	92,698
Lorain	27,017	40,460	13,887	11,855	24,177	25,222	67,214
Sandusky	5,179	28,238	42,555	29,572	27,991	93,686	85,488
Toledo	74,603	114,501	216,318	243,818	131,047	313,393	315,036
Charlotte	1,153	....	....	1,275	613	....	....
Fairport	126,955	97,532	44,621	37,094	38,530	22,408	4,320
Ogdensburg	....	2,800	....	1,133	....	....	1,368
Huron, Ohio	11,229	29.605	44,378	4,159	5,400	30,148	13,950
Other ports	9,950	975	18,323	4,192	25,450	....	13,600
Total, lake	1,336,603	1,487,483	1,493,528	1,586,965	1,775,767	1,651,442	1,765,021
By railroad	109,920	100,312	62,280	102,096	144,097	157,151	188,468
Receipts	1,446,523	1,587,795	1,555,808	1,689,061	1,919,864	1,808,593	1,953,489

Shipments of coal from Milwaukee for seven years.

Shipped by—	1895.	1896.	1897	1898.	1899.	1900.	1901.
	Short tons.	*Short tons.*	*Short tons.*	*Short tons.*	*Short tons.*	*Short tons.*	*Short tons.*
Chicago, Milwaukee and St. Paul Rwy	398,053	264,650	362,751	398,668	327,369	378,901	459,252
Chicago and Northwestern Rwy	221,357	169,409	247,979	245,472	210,495	241,992	255,948
Wisconsin Central R. R	17,990	12,318	42,017	31,538	35,851	47,629	56,834
Lake	3,070	306	120	4,180	....	5,950	4,616
Total	640,470	446,683	652,867	679,858	573,715	674,472	776,650

Receipts of coal at Milwaukee by lake and rail annually from 1863 to 1901, inclusive.

[Short tons.]

Year.	Quantity.	Year.	Quantity.
1863	43,215	1883	612,584
1864	44,503	1884	704,166
1865	36,369	1885	775,750
1866	66,616	1886	759,681
1867	74,568	1887	842,979
1868	92,992	1888	1,122,243
1869	87,690	1889	980,678
1870	122,865	1890	996,657
1871	175,526	1891	1,156,033
1872	210,194	1892	1,374,414
1873	229,784	1893	1,249,732
1874	177,655	1894	1,337,046
1875	228,674	1895	1,446,423
1876	188,444	1896	1,587,795
1877	264,784	1897	1,555,808
1878	239,667	1898	1,689,061
1879	350,840	1899	1,919,864
1880	368,568	1900	1,808,593
1881	550,027	1901	1,953,489
1882	593,842		

Freight rates from Buffalo to upper lake ports in 1901.

Month.	Chicago.	Milwaukee.	Duluth and Superior.	Racine.
	Cents.	*Cents.*	*Cents.*	*Cents.*
April	40@50	40	40	50
May	40@50	40	30@40	50
June	40@50	40	30@35	50
July	35@50	35@40	35	40@50
August	35@60	40@50	35	40@60
September	50@70	50@60	35	60
October	60@70	60	35	60@70
November to close	60@100	60@100	35@60	70@90

Yard prices per ton of coal at Milwaukee during the year 1901, reported by Milwaukee Western Fuel Company.

Month.	House use.		Cannel.		Steam coal.	
	Lackawanna and Scranton.	Pocahontas.	Bird's-eye.	Butts.	Hocking.	Pittsburg.
January	$7.00	$6.00	$7.50	$6.50	$3.40	$3.65
February	7.00	6.00	7.50	6.50	3.40	3.65
March	7.00	6.00	7.50	6.50	3.40	3.65
April	7.00	6.00	7.50	6.50	3.40	3.65
May	6.75	5.50	7.50	6.50	3.15	3.40
June	6.75	5.50	7.50	6.50	3.15	3.40
July	7.00	5.50	7.50	6.50	3.15	3.40
August	7.00	5.00	7.50	6.50	3.15	3.40
September	7.00	5.00	7.50	6.50	3.15	3.40
October	7.00	5.00	7.50	6.50	3.15	3.40
November	7.00	5.00	7.50	6.50	3.15	3.40
December	7.00	5.25	7.50	6.50	3.15	3.40

CINCINNATI, OHIO.

The following review of the coal trade of Cincinnati has been prepared by Mr. C. B. Murray, superintendent, Chamber of Commerce.

There was a considerable increase in the supply of coal at Cincinnati in the year 1901 as compared with the preceding year, when the record was the lowest since 1890, due in large part to deficiency from the Pittsburg district. This deficiency as compared with the receipts of earlier years was continued in 1901, but not to an extent equal to 1900. The aggregate arrivals for the year from all sources were 80,064,000 bushels, compared with 68,625,000 for 1900, making an annual average of 78,037,000 for five years ending with 1901, as compared with an annual average of 76,752,000 for the preceding period of five years.

For the past year the Kanawha district not only maintained its proportion of the total supply as compared with earlier years, but marked a high record, by both river and rail lines of transportation, the aggregate representing 61 per cent of the receipts, against 28 per cent from the Pittsburg district and 11 per cent for all other.

The proportion of coal received by river and by rail was about the same as for the preceding year, representing 64 per cent for river against 65 the preceding year, and 36 per cent for rail receipts against 35 the preceding year.

Shipments of coal from this market in 1901 were decidedly increased, representing 15,748,000 bushels by rail and 5,208,000 bushels by river, an aggregate of 20,956,000 bushels, compared with 9,817,000 bushels by rail and 2,812,000 by river, or an aggregate of 12,629,000 bushels for 1900 and 12,898,000 bushels for 1899.

For coal afloat in this market the quotations were without much change during the year. In January the price was 8 cents per bushel for Pittsburg product and 7½ cents for Kanawha. Subsequently the Pittsburg product was quoted at 7½ cents until December, when some transactions were reported on a lower basis. The general average for the year was 7½ cents, compared with a similar average for the preceding year, and an annual average of 6.46 cents for ten years prior to 1901. Kanawha coal sold at 7½ cents until May, when it was reduced to 7 cents, at which price it continued to the end of the year, making a yearly average of 7.15 cents.

For coal delivered to consumers the price for Pittsburg was $2.50 per ton of 2,000 pounds in January, $3 subsequently until August, $2.75 until October, and $3 to the end of the year, making a general average of $2.92, compared with $3.03 for 1900, and an annual average of $2.63 for ten years prior to 1901. Kanawha coal sold at $2.50 per ton in January, $3 until May, $2.75 to $3 until August, $2.75 until October, and $3 for nearly all of the remainder of the year, making a general average of $2.88 for the year, compared with $3.05 for 1900, and an annual average of $2.62 for ten years prior to 1901.

In the manufacture of gas, locally, there was consumed 131,000 tons, or 3,625,000 bushels, of coal in 1901, compared with 3,200,000 bushels the preceding year, an increase of about 11 per cent. The quantity of gas sent out was 1,246,000,000 cubic feet, compared with 1,135,000,000 cubic feet in 1900. The net price of gas for illuminating purposes in this city is 75 cents per 1,000 feet, and for fuel purposes through special-service pipes 50 cents per 1,000 feet.

Since 1872 the receipts of coal at Cincinnati have been as follows:

Receipts of coal at Cincinnati since September 1, 1872.

[Bushels.]

Year.	Pittsburg (Youghiogheny).	Kanawha by river.	Ohio River.	Cannel.	Anthracite.	Other kinds.	Total.
1872-73	24,962,373	....	[a]11,075,072	1,162,052	75,000	....	37,274,497
1873-74	24,014,681	....	[a]10,398,153	710,000	112,000	....	35,234,834
1874-75	24,225,002	4,476,619	4,277,327	565,352	248,750	1,597,260	35,390,310
1875-76	27,017,592	6,004,675	4,400,792	409,358	282,578	2,068,322	40,183,317
1876-77	28,237,572	3,631,823	5,141,150	322,171	376,125	1,913,793	39,622,634
1877-78	26,743,055	6,386,623	3,288,008	380,768	439,350	1,654,425	38,892,229
1878-79	20,769,027	6,134,039	4,068,452	333,549	768,750	2,136,850	34,210,667
1879-80	31,750,968	8,912,801	4,268,214	202,489	712,075	2,351,699	48,198,246
1880-81	23,202,084	10,715,459	3,151,934	67,684	770,525	2,336,752	40,244,438
1881-82	37,807,961	13,950,802	3,560,881	77,336	779,925	3,090,715	59,267,620
1882-83	33,895,064	13,260,347	3,309,534	180,621	977,250	2,997,216	54,620,032
1883-84	32,239,473	15,926,743	2,956,688	293,010	1,085,350	3,910,795	56,412,059
1884-85	32,286,133	14,588,573	3,007,078	314,774	1,257,900	2,683,864	54,138,322
1885-86	34,933,542	17,329,349	939,746	205,717	1,287,925	2,720,250	57,416,529
1886-87	37,701,094	20,167,875	338,435	129,503	1,314,775	3,693,850	63,345,532
1887-88	41,180,713	20,926,596	1,533.358	26,098	1,328,225	5,710,649	70,705.639
1888-89	36,677,974	23,761,853	544,940	12,129	1,020.525	3,075,000	65,092,421
1889-90	42,601,615	19,221,196	454,385	....	1,001 175	4,709.775	67,988,146
1890-91	43,254.460	19,115,172	1,479,670	15,111	1.118,671	7,362,698	72,345,782

Receipts of coal at Cincinnati since September 1, 1872—Continued.

[Bushels.]

Year.	Pittsburg (Youghiogheny).	Kanawha by river.	Ohio river.	Cannel.	Anthracite.	Other kinds.	Total.
1891, 4 months	13,766,390	6,288,442	234,940		402,528	4,437,139	25,129,439
1892 *a*	42,272,348	19,214,704	768,588		1,268,170	13,335,006	76,858,816
1893	28,643,562	24,971,261	405,202		759,626	25,832,374	80,612,025
1894	40,156,667	16,398,039	158,334		661,548	19,083,527	76,458,115
1895	26,675,823	15,106,095	14,400		1,227,000	27,119,823	70,143,141
1896	36,696,759	22,015,133	130,217		1,171,000	19,676,000	79,689,109
1897	35,040,790	17,941,769	60,217		1,251,250	24,468,000	78,762,026
1898	41,271,142	19,949,098	95,590		948,125	21,679,000	83,942,955
1899	33,339,381	18,987,364	29,533		1,291,250	25,144,000	78,791,528
1900	19,066,472	24,586,857	917,206		437,500	23,617,500	68,625,535
1901	22,379,828	27,516,166	1,219,387		632,500	28,316,500	80,064,381

a Calendar years since 1892.

NOTE.—The "other kinds" in above table include 21,237,000 bushels of Kanawha by rail in 1901, and Kanawha rail coal previously.

The following is a summary of the coal movement at Cincinnati for two years:

Summary of coal movements at Cincinnati in 1900 and 1901, in bushels.

[Bushels.]

Details.	1901.	1900.	Details.	1901.	1900.
Total received	80,064,381	68,625,535	Anthracite	632,500	437,500
Pittsburg	22,379,828	19,066,472	Total:		
Ohio River	1,219,387	917,206	By river	51,115,381	44,570,535
Kanawha:			By rail	28,949,000	24,055,000
By river	27,516,166	24,586,857	Shipped:		
By rail	21,237,000	17,713,000	By river	5,207,771	2,811,771
Total Kanawha	48,753,166	42,299,857	By rail	15,747,875	9,817,375
Other kinds by rail	7,079,500	5,904,500			

The average annual consumption of coal at Cincinnati in recent years has been something over 60,000,000 bushels.

As near as can be ascertained the local consumption is pretty evenly divided between factory and household purposes.

The yearly range and average prices of Pittsburg coal, afloat and delivered, per bushel, based on weekly records, compare for a series of years as shown in the following compilation:

Yearly range and average prices for Pittsburg coal at Cincinnati.

[Cents per bushel.]

Year.	Afloat.			Delivered.		
	Lowest.	Highest.	Average.	Lowest.	Highest.	Average.
1888-89	6	8½	6.71	9	11¾	9.95
1889-90	6	8	6.78	9	10¾	9.69
1890-91	6½	8½	7.28	10	10¾	10.24
1892	6½	8½	7.49	9	12½	10.36
1893	6½	8¾	7.58	9	19¾	11.04
1894	5¼	9	6.34	7¼	10¾	9.11
1895	5½	6½	6.00	8⅛	10¾	9.00
1896	5½	6	5.73	8⅛	9	8.40
1897	5½	5¾	5.70	5¾	10¾	8.10
1898	5	6	5.66	7¼	9	8.05
1899	4½	7½	5.30	8⅛	11¾	9.50
1900	7½	8	7.52	10¾	11¾	10.90
1901	6½	8	7.13	9	10¾	10.15

Coal from the Kanawha, Virginia, and West Virginia regions, sells at the same, or about the same, prices as are obtained for the product from the Pittsburg district. Sales afloat are on the bushel basis, 72 pounds; sales delivered are on the ton basis, 2,000 pounds, and represent screened or lump grade.

The receipts of coke for the year were 6,723,000 bushels, and the quantity locally manufactured was 4,498,000 bushels, making a total of 11,221,000 bushels, compared with 8,246,000 bushels the preceding year. For city manufacture the average price for the year was 9.37 cents per bushel; of gas-house, 7.58 cents; of Connellsville, $5.69 per ton.

ST. LOUIS, MO.

The following summary of the coal trade of St. Louis for the year 1901 is furnished by Mr. W. F. Saunders, secretary and general manager of the Business Men's League of that city:

The year of 1901 was one of unexampled business prosperity in St. Louis without one single depressing feature, such as the street railway strike had been the year before, and in consequence manufacturing and all other industries went forward steadily. The World's Fair, of course, is responsible for much of this growth. The coal trade showed this business elation most decidedly, both in prices and receipts. Illinois lump coal, both standard and high grade, averaged much higher through the year. The prices of anthracite, large and small, also went up considerably. During December, when a cold wave, lasting nearly three weeks, came upon the city, the dealers were found lacking in supply and many of them who had large contracts suffered considerable loss, the responsible dealers, of course, supplying the coal at the low figures they had contracted for, although it cost them much more to get it and deliver it. The supply of coke was too large for the market, and prices ranged much lower than they were in 1900.

The following quotations show the range of prices during 1901, the figures including bridge tolls and representing prices free on board St. Louis:

Coal prices at St. Louis, Mo., during 1901.

Kind.	Highest.	Lowest.	Closing.
Standard Illinois lump coal	$2.80	$1.40	$2.80
High-grade Illinois lump coal	3.30	1.80	3.30
Anthracite, large	6.65	6.00	6.65
Anthracite, small	6.90	6.25	6.90
Connellsville coke	5.55	5.05	5.55
New River coke	5.30	5.05	5.30
Indiana coke	....	....	....
Kentucky coke	3.80	3.70	3.80
Gas coke	4.25	3.30	4.25

The following table shows the growth in the receipts of coal and coke at St. Louis during the last ten years:

Coal and coke receipts at St. Louis since 1892.

Year.	Soft coal.	Hard coal.	Coke.
	Bushels.	*Tons.*	*Bushels.*
1892	82,302,228	187,327	8,914,400
1893	87,769,375	173,653	7,807,000
1894	74,644,375	186,494	6,365,900
1895	88,589,935	207,784	7,130,300
1896	87,677,600	218,955	5,395,900
1897	83,730,980	172,933	5,671,350
1898	83,562,450	225,616	7,762,250
1899	103,115,730	292,118	6,795,100
1900	104,317,650	180,550	7,942,900
1901	118,860,775	200,797	11,746,592

SAN FRANCISCO, CAL.

Mr. J. W. Harrison, in his annual report "The Coal Trade of San Francisco," says that notwithstanding the general belief that the quantity of coal consumed in California last year would fall at least 25 per cent below that of 1900, the decrease was merely nominal. Considering that there was a displacement of at least 1,000,000 tons of coal in 1901 by the substitution of fuel oil, the question of most interest to the coal trade is, What has become of the coal? As fuel is an infallible indicator of progress and profit, the year 1901 must be chronicled as a memorable year for California. Coal has been gradually eliminated as locomotive fuel, and all the power houses for the cable roads are now using oil entirely, so that the principal outlet for steam coal in San Francisco has been for army transports and by ocean-going steamers. Mr. Harrison is of the opinion that when a device can be created which will cause the substitution of oil for coal as a domestic fuel, the use of coal in California will almost entirely cease, but he qualifies this statement with the opinion that it will not be easy to eradicate the odor and smoke from the use of oil. They have so far not been controlled.

Coal values in San Francisco have been greatly declining, being forced to do so by competition. Australian coals at the beginning of 1901 were selling at fully $1.50 per ton over the price which ruled at the close of the year. This forced the Washington and British Columbia mining companies to market their output at very low figures, with the exception of those collieries which produce a coal especially adapted to household purposes. There was an actual difference of fully $2 per ton in the selling price locally of domestic and steam coal between the first and the last of the year.

The various sources from which the coal supply of California has been derived are as follows:

Sources of coal consumed in California.

[Short tons.]

Source.	1891.	1892.	1893.	1894.	1895.
British Columbia	652,657	554,600	588,527	647,110	651,295
Australia	321,197	314,280	202,017	211,733	268,960
England and Wales	168,586	210,660	151,269	157,562	201,180
Scotland	31,840	24,900	18,809	18,636	4,098
Eastern (Cumberland and anthracite)	42,210	35,720	18,960	16,640	26,863
Franklin, Green River, Cedar River, etc.	178,230	164,930	167,550	*a* 153,199	150,888
Carbon Hill, South Prairie, etc	196,750	218,390	261,435	241,974	256,267
Mount Diablo and Coos Bay	90,684	66,150	63,460	65,263	84,954
Japan, etc	20,679	4,220	7,758	*b* 15,637	9,015
Total	1,702,833	1,593,850	1,479,785	1,527,754	1,653,520

a Including Seattle.

b Including Alaska.

Sources of coal consumed in California—Continued.

[Short tons.]

Source.	1896.	1897.	1898.	1899.	1900.	1901.
British Columbia	551,852	558,372	651,208	623,133	766,917	710,330
Australia	273,851	281,666	201.931	139,333	178,563	175,959
England and Wales	156,368	107,969	75,115	93,263	54,099	52,270
Scotland	8,356	4,081	5,056	None.	None.	None.
Eastern (Cumberland and anthracite)	17,907	21,335	37,560	38,951	17,319	27,370
Seattle (Franklin, Green River, etc.)	128,919	220,175	283,963	271,694	250,590	240,574
Carbon Hill, South Prairie, etc	255,923	286,205	348,474	355,756	418,052	433,817
Mount Diablo, Coos Bay, and Tesla	110,237	115,150	172,506	189,507	160,915	143,318
Japan and Rocky Mountains	2,247	6,587	26,560	28,390	42,673	51,147
Total	1,505,660	1,601,540	1,802,373	1,740,027	1,889,128	1,834,785

It is necessary to include the deliveries at the ports of Los Angeles and San Diego to arrive at an accurate statement of the consumption of coal in the State. These are added in the above-named sources of supply. The total amount received by water at these two ports in 1901 aggregated 240,777 tons, as compared with 165,965 short tons in 1900, 184,747 short tons in 1899, and 154,402 short tons in 1898.

In regard to the effect which the consumption of petroleum has had upon the coal trade, Mr. Harrison writes as follows:

Fuel oil.—This has proved a boon to California, so far-reaching in its beneficial effects that its future advantages can not be estimated, and it is questionable to-day if the discovery of gold will prove as potent a factor in creating a prosperous and permanent future for us as oil. We produce nearly 1,000,000 tons of varied grains annually, and use no fertilizing products; we export thousands of tons of nearly every fruit grown in and out of the Tropics; we handle more canned fish than any other State in the Union; we unearth immense quantities of every metal known to commerce; we have the most equable climate on earth, and within two years we have become (or certainly will become within two years more) the largest oil producers in the world, and are so geographically situated that we have the oriental and colonial markets under our control to take our surplus refined oil. Our population is rapidly increasing, real estate is being sought at marked-up values, and Eastern capital is seeking investments here on every side. With all this the producers of oil have been so far the least benefited, the main advantages having gone to the consumers. Contracts have been made this year at 60 cents per barrel, with the freight paid by the vendor of over 40 cents per barrel. At the same time it was well known that consumers were substituting oil at a value equal to $2.50 per ton for coal which was being then used at over $5 per ton. Better prices for oil now prevail.

Coke.—The annual record of coke receipts in the State is of that which comes by water, as the larger portion of the quantity received by rail is delivered to interior consumers, and it is not possible even to approximate the amount so received. This factor is estimated by Mr. Harrison to aggregate from 9,500 to 10,000 tons. The total amount received by water in 1901 was 34,533 tons, as compared with 41,741 tons in 1900. Over 50 per cent of the coke thus received comes direct by sail from England, 7,794 tons from Belgium and Germany, 6,906 tons from British Columbia, and 1,825 tons from Australia.

SEATTLE, WASH.

The following review of the coal trade at Seattle has been prepared by Mr. Lovett M. Wood, editor Trade Register:

The coal business of Seattle for 1901 increased 82,466 tons in receipts over 1900, while the shipments only increased 4,117 tons, as shown by the following tables compiled by the Trade Register from exclusive reports furnished by all the mining companies and the railroads. The difference in receipts and shipments fully bears out the writer's forecast of the previous year, both as to output and the increase in population, industrial and shipping requirements of Seattle. The disaster of the mine at Nanaimo, British Columbia, cut off one of California's principal coal supplies, which led to a greater demand upon the Washington mines shipping from Puget Sound to coast points. The transcontinental railroads brought in over 1,500 tons of coal to Seattle from Duluth and other points, but there is not much prospect for Eastern points supplying this market with coal. At times the British Columbia mines attempt to gain a market here, but the result has always proved a failure. Washington's coal areas are too extensive and the prices too low to warrant serious competition from outside mines. As the years go by, the mines are better developed and the product shows better quality. Besides the coal coked by the gas companies, there were 145 tons shipped in during February of last year.

Shipments of coal from the mines and Eastern points to Seattle, Wash., in 1901.

[Short tons.]

Mine.	Quantity.	Mine.	Quantity.
Issaquah Coal Co	119,170	Roslyn	61,149
Black Diamond	236,048	Leary	66,747
Newcastle	146,671	Wilkerson, Gale Creek	9,329
Franklin	142,917	Burnett	2,454
Renton	72,627	Cle-Elum	10,388
Cedar Mountain	8,053	Shoreham	33
Sunset	1,730	West Superior	400
Fairfax	1,205	Duluth	88
Carbonado	2,844	Great Northern Railroad from the East	923
Lawson	109,012	Total	991,788

Receipts and exports of coal at Seattle, Wash., in 1901, by months.

[Short tons.]

Month.	Receipts.	Exports.[a]	Month.	Receipts.	Exports.[a]
January	88,198	35,475	September	73,376	39,120
February	88,278	41,885	October	95,458	40,005
March	88,456	47,315	November	97,626	43,020
April	65,193	32,672	December	96,516	38,866
May	82,850	40,930	Total 1901	991,788	482,679
June	72,823	45,559	Total 1900	909,322	478,562
July	73,894	43,225			
August	69,120	34,607	Increase in 1901	82,466	4,117

[a] Foreign and domestic points (mostly San Francisco, Cal.).

Receipts and exports of coal at Seattle, Wash., 1890 to 1901 inclusive.

[Short tons.]

Year.	Receipts.	Exports.[a]	Year.	Receipts.	Exports.[a]
1890	487,215	....	1896	425,103	194,771
1891	421,587	....	1897	472,311	287,883
1892	416,174	....	1898	622,284	378,578
1893	461,034	342,114	1899	821,365	[b] 444,428
1894	437,939	318,670	1900	909,322	478,562
1895	363,979	257,739	1901	991,788	482,679

[a] Foreign and domestic points (mostly San Francisco, Cal.). [b] 16,400 tons to foreign.

PRODUCTION OF COAL BY STATES.

There were 26 States and 2 Territories which contributed to the total coal production of the United States in 1901. This statement does not include Alaska, in which Territory a small amount was produced, principally for experimental purposes, in 1901. Idaho, which produced a small amount in 1900, is not credited with any output in 1901. The two Territories which figure among the coal producers are Indian Territory and New Mexico. Of the 28 States and Territories which produced coal in 1901, 23 exceeded a total of 1,000,000 tons, as against 21 having this record in 1900, and 19 in 1899. One State—Pennsylvania—had a total product of nearly 150,000,000 short tons, including anthracite and bituminous coal. Three others exceeded 20,000,000 short tons—Illinois, West Virginia, and Ohio—and six more—Alabama, Indiana, Colorado, Iowa, Kentucky, and Maryland—produced over 5,000,000 tons. All of the six leading coal-producing States are east of the Mississippi River, and of these all but two—Illinois and Indiana—belong to the Appalachian system. The States east of the Mississippi River in 1901 produced 256,676,993 short tons, while the States west of the Mississippi River produced 36,621,523 short tons, or but 12 per cent of the total. Of the total output of the States east of the Mississippi River the States north of the Ohio and Potomac rivers produced 211,325,565 short tons, or 72 per cent.

In the following tables are shown the statistics of production in the States east and west of the Mississippi and the Eastern States divided by the Ohio and Potomac rivers. The figures are given for the years 1880, 1890, 1900, and 1901. An interesting feature of this statement is the percentage of increase shown between 1880 and 1901 in these different sections. The States east of the Mississippi River and north of the Ohio and Potomac rivers have a little more than trebled their production. The States west of the Mississippi have increased their production eightfold, while in the States east of the Mississippi and south of the Ohio and Potomac rivers the production in 1901 was twelve times that of 1880.

Coal production in States west of Mississippi River.

State.	1880.		1890.	
	Production.	Value.	Production.	Value.
	Short tons.		*Short tons.*	
Arkansas	14,778	$33,535	399,888	$514,595
California	236,950	663,013	110,711	283,019
Colorado	462,747	1,041,350	3,094,003	4,344,196
Idaho	....	....	....	....
Indian Territory	....	....	869,229	1,579,188
Iowa	1,461,116	2,507,453	4,021,739	4,995,739
Kansas	771,442	1,517,444	2,259,922	2,947,517
Missouri	884,304	1,464,425	2,735,221	3,382,858
Montana	224	800	517,477	1,252,492
Nebraska	200	750	1,500	4,500
New Mexico	....	....	375,777	504,390
North Dakota	....	....	30,000	42,000
Oregon	43,205	97,810	61,514	177,875
Texas	....	....	184,440	465,900
Utah	14,748	33,645	318,159	552,390
Washington	145,015	389,046	1,263,689	3,426,590
Wyoming	589,595	1,080,451	1,870,366	3,183,669
Total	4,621,324	8,829,722	18,113,635	27,656,918

Coal production in States west of Mississippi River—Continued.

State.	1900.		1901.	
	Production.	Value.	Production.	Value.
	Short tons.		*Short tons.*	
Arkansas	1,447,945	$1,653,618	1,816,136	$2,068,613
California	171,708	523,231	151,079	394,106
Colorado	5,244,364	5,858,036	5,700,015	6,441,891
Idaho	10	50	....	....
Indian Territory	1,922,298	2,788,124	2,421,781	3,915,268
Iowa	5,202,939	7,155,341	5,617,499	7,822,805
Kansas	4,467,870	5,454,691	4,900,528	5,991,599
Missouri	3,540,103	4,280,328	3,802,088	4,707,164
Montana	1,661,775	2,713,707	1,396,081	2,009,316
Nebraska	....	....	....	....
New Mexico	1,299,299	1,776,170	1,086,546	1,546,652
North Dakota	129,883	158,348	166,601	214,151
Oregon	58,864	220,001	69,011	173,646
Texas	968,373	1,581,914	1,107,953	1,907,024
Utah	1,147,027	1,447,750	1,322,614	1,666,082
Washington	2,474,093	4,700,068	2,578,217	4,271,076
Wyoming	4,014,602	5,457,953	4,485,374	6,060,462
Total	33,751,153	45,769,330	36,621,523	49,189,855

Coal production in States north of Ohio and Potomac rivers.

State.	1880.		1890.	
	Production.	Value.	Production.	Value.
	Short tons.		*Short tons.*	
Illinois	6,115,377	$8,779,832	15,292,420	$14,171,230
Indiana	1,454,327	2,150,258	3,305,737	3,259,233
Maryland	2,228,917	2,585,537	3,357,813	2,899,572
Michigan	100,800	224,500	74,977	149,195
Ohio	6,008,595	7,719,667	11,494,506	10,783,171
Pennsylvania:				
Anthracite	28,711,379	42,282,948	46,468,641	66,383,772
Bituminous	18,425,163	18,567,129	42,302,173	35,376,916
Total	63,044,558	82,309,871	122,296,267	133,023,089

State.	1900.		1901.	
	Production.	Value.	Production.	Value.
	Short tons.		*Short tons.*	
Illinois	25,767,981	$26,927,185	27,331,552	$28,163,937
Indiana	6,484,086	6,687,137	6,918,225	7,017,143
Maryland	4,024,688	3,927,381	5,113,127	5,046,491
Michigan	849,475	1,259,683	1,241,241	1,753,064
Ohio	18,988,150	19,292,246	20,943,807	20,928,158
Pennsylvania:				
Anthracite	57,367,915	85,757,851	67,471,667	112,504,020
Bituminous	79,842,326	77,438,545	82,305,946	81,397,586
Total	193,324,621	221,290,028	211,325,565	256,810,399

Coal production in States south of Ohio and Potomac rivers.

State.	1880.		1890.	
	Production.	Value.	Production.	Value.
	Short tons.		*Short tons.*	
Alabama	323,972	$476,911	4,090,409	$4,202,469
Georgia	154,644	231,605	228,337	238,315
Kentucky	946,288	1,134,960	2,701,496	2,472,119
North Carolina	350	400	10,262	17,864
Tennessee	495,131	629,724	2,169,585	2,395,746
Virginia	43,079	99,802	784,011	589,925
West Virginia	1,829,844	2,013,671	7,394,654	6,208,128
Total	3,793,308	4,587,073	17,378,754	16,124,566

State.	1900.		1901.	
	Production.	Value.	Production.	Value.
	Short tons.		*Short tons.*	
Alabama	8,394,275	$9,793,785	9,099,052	$10,000,892
Georgia	315,557	370,022	342,825	411,685
Kentucky	5,328,964	4,881,577	5,469,986	5,213,076
North Carolina	17,734	23,447	12,000	15,000
Tennessee	3,509,562	4,003,082	3,633,290	4,067,389
Virginia	2,393,754	2,123,222	2,725,873	2,353,989
West Virginia	22,647,207	18,416,871	24,068,402	20,848,184
Total	42,607,053	39,612,006	45,351,428	42,910,215

The production in the several States and Territories in 1901 and preceding years is discussed with more detail in the following pages.

ALABAMA.

Total production for 1901, 9,099,052 short tons; spot value, $10,000,892.

Alabama ranks fifth among the coal-producing States, being preceded by Pennsylvania, Illinois, West Virginia, and Ohio, in the order named. Among the Southern States it stands second, with West Virginia first.

The production in 1901 was the largest in the history of the State, and exceeded for the first time a total of 9,000,000 tons. As compared with 1900, the output last year exhibited an increase of 704,777 short tons, equal to 8.4 per cent. This increase in 1901 was preceded by an increase of 800,859 short tons in 1900, 1,058,133 short tons in 1899, and 641,513 short tons in 1898, the production in each of these years being the largest up to that time. In fact, the production of coal in Alabama has increased annually without exception since 1894, compared with which year the output in 1901 shows an increase of 107 per cent.

Considering the record made in 1901, it does not appear as if the threatened invasion of the markets for Alabama coal by crude petroleum has been realized, at least not to any detriment to the coal industry of Alabama. The continued and increasing activity in the iron and steel industries created a demand for any coal that had been displaced by the use of oil, and the action of the railroads in cutting freights to New Orleans and other Gulf ports enabled the coal producers to meet this new competition in those markets.

One of the interesting developments of the year was the purchase of some of the large coal-producing properties in Alabama by the Monongahela River Consolidated Coal and Coke Company, of Pittsburg, Pa. This action was probably taken in order to protect the Gulf and Mississippi River markets for Pittsburg coal, the most of which, now shipped by river, being the product of the mines controlled by the Monongahela River Consolidated Coal and Coke Company.

The first year for which there is any record of coal production in Alabama was 1870, although it is known that coal was produced in the State previous to that year, and it is probable that between 1860 and 1870 the annual production in some years exceeded that of the census year of 1870. The production in 1870, as reported by the Ninth Census, was 13,200 tons. It increased rapidly until in 1880 it amounted to a little over 300,000 tons. This was a large production for the time, but the real development of the Alabama coal fields may be said to have started with the boom which struck the city of Birmingham in 1882, in which year the product amounted to 896,000 tons. It nearly doubled in 1883, reaching 1,568,000 tons, rose to 2,240,000 tons in 1884, and to 2,492,000 tons in 1885. With the collapse of the boom the production in 1886 fell off to 1,800,000 tons. After this came a period of substantial growth, which was interrupted only by the panic and hard times of 1893 and 1894. These two years are the only exceptions to a steady growth in the output of coal in Alabama since 1886.

In the following tables is presented a statement of the production of coal in Alabama during 1900 and 1901 by counties, showing the distribution of the product for consumption, the value, and the statistics of labor employed in the State. This table shows that in 1901 there were 2,182,477 short tons made into coke. The actual amount of coal made into coke in this State last year was 3,849,908 short tons. This difference is due to the fact that a large amount of coal is shipped from the mines to ovens at a distance. Many of the ovens are located in the vicinity of Birmingham, and the coal is shipped to them from the mines some distance away. In these cases the coal is reported on the coal schedules as shipped from the mines. In 1900 the amount of coal made into coke in Alabama was 3,582,547 short tons, though it appears in this report as 1,950,199 short tons.

Coal production of Alabama in 1900, by counties.

County.	Loaded at mines for shipment.	Sold to local trade and used by employees.	Used at mines for steam and heat.	Made into coke.	Total production.	Total value.	Average price per ton.	Average number of days active.	Average number of employees.
	Short tons.	*Short tons.*	*Short tons.*	*Short tons.*	*Short tons.*				
Bibb	939,505	917	23,784	579	964,785	$1,183,072	$1.23	265	1,257
Blount and Cullman	13,472	5,100	....	....	18,572	21,072	1.13	233	53
Etowah	20,855	....	....	....	20,855	24,718	1.19	142	78
Jefferson	3,258,260	32,145	127,856	1,837,035	5,255,296	6,144,993	1.17	269	7,943
Marion and Winston	49,663	200	....	....	49,863	63,082	1.27	217	136
St. Clair	87,128	54,140	4,060	10,942	156,270	184,040	1.18	205	307
Shelby	116,447	8,840	10,545	....	135,832	210,072	1.55	176	523
Tuscaloosa	155,066	5,104	6,609	101,643	268,422	298,458	1.11	237	657
Walker	1,467,615	5,145	16,620	....	1,489,380	1,629,278	1.10	249	3,013
Small mines	....	35,000	....	....	35,000	35,000	......	....	......
Total	6,108,011	146,591	189,474	1,950,199	8,394,275	9,793,785	1.17	257	13,967

Coal production of Alabama in 1901, by counties.

County.	Loaded at mines for shipment.	Sold to local trade and used by employees.	Used at mines for steam and heat.	Made into coke.	Total production.	Total value.	Average price per ton.	Average number of days active.	Average number of employees.
	Short tons.	*Short tons.*	*Short tons.*	*Short tons.*	*Short tons.*				
Bibb	1,213,620	2,881	40,914	1,438	1,258,853	$1,512,562	$1.20	235	1,824
Blount and Cullman	142,047	1,650	....	....	143,697	173,127	1.20	148	328
Etowah	86,941	6,050	600	....	93,591	119,244	1.27	210	186
Jefferson	3,436,757	25,255	139,665	1,948,038	5,549,715	5,965,291	1.07	259	9,492
Marion and Winston	69,335	170	....	....	69,505	86,169	1.24	151	209
St. Clair	136,935	624	3,257	....	140,816	164,742	1.17	198	293
Shelby	139,405	1,382	8,345	....	149,132	226,826	1.52	256	396
Tuscaloosa	130,803	2,821	8,093	233,001	374,718	399,440	1.07	247	1,069
Walker	1,260,751	9,196	14,078	....	1,284,025	1,318,491	1.02	186	3,573
Small mines	....	35,000	....	....	35,000	35,000	......	....	......
Total	6,616,594	85,029	214,952	2,182,477	9,099,052	10,000,892	1.10	236	17,370

The returns for 1901 indicate a considerable decrease in the amount of coal in Alabama which was mined by the use of undercutting or shearing machines, although the number of machines in use was twenty-eight more in 1901 than in 1900. The machine-mined product decreased from 370,150 short tons in 1900 to 289,051 short tons in 1901. There were 82 machines in use in 1901 as compared with 54 machines in 1900.

Such labor troubles as occurred in Alabama during 1901 were of little importance and had no material effect upon the production. There were nine collieries in which strikes occurred, and the number of men made idle was 1,170. The average time lost was 12 days per man.

The distribution of the coal product of Alabama from 1889 to 1901 has been as follows:

Distribution of the coal product of Alabama from 1889 to 1901, inclusive.

Year.	Loaded at mines for shipment.	Sold to local trade and used by employees.	Used at mines for steam and heat.	Made into coke.	Total product.	Total value.	Average price per ton.	Average number of days active.	Average number of employees.
	Short tons.	*Short tons.*	*Short tons.*	*Short tons.*	*Short tons.*				
1889	2,327,209	59,945	79,515	1,106,314	3,572,983	$3,961,491	$1.10	248	6,975
1890	2,487,983	84,578	88,952	1,428,896	4,090,409	4,202,469	1.03	217	10,961
1891	2,822,813	91,456	100,160	1,745,352	4,759,781	5,087,596	1.07	268	9,302
1892	3,122,075	37,843	135,627	2,233,767	5,529,312	5,788,898	1.05	271	10,075
1893	3,536,935	59,599	96,412	1,443,989	5,136,935	5,096,792	.99	237	11,294
1894	3,269,548	43,911	130,404	953,315	4,397,178	4,085,535	.93	238	10,859
1895	3,610,433	272,551	137,021	1,673,770	5,693,775	5,126,822	.90	244	10,346
1896	3,555,493	285,416	138,268	1,769,520	5,748,697	5,174,135	.90	248	9,894
1897	4,543,597	86,790	126,187	1,137,196	5,893,770	5,192,085	.88	233	10,597
1898	4,926,828	107,576	145,808	1,355,071	6,535,283	4,932,776	.75	250	10,733
1899	4,701,612	79,994	155,514	2,656,296	7,593,416	8,256,462	1.09	238	13,481
1900	6,108,011	146,591	189,474	1,950,199	8,394,275	9,793,785	1.17	257	13,967
1901	6,616,594	85,029	214,952	2,182,477	9,099,052	10,000,892	1.10	236	17,370

In the following table is shown the total production by counties for the last six years, with the increases and decreases in 1901 as compared with the preceding year. The table shows that there was increased activity in all the coal-producing counties with the exception of St. Clair and Walker. The production of Walker County decreased 205,355 short tons, and that of St. Clair fell off 15,454 short tons. Jefferson and Bibb counties were rivals for the largest increase in production, each having a little over 294,000 tons to its credit in the way of increase.

Coal production of Alabama since 1896, by counties.

[Short tons.]

County.	1896.	1897.	1898.	1899.	1900.	1901.	Increase, 1901.	Decrease, 1901.
Bibb	710,842	671,077	810,891	912,263	964,785	1,258,853	294,068	....
Blount	32,760	37,350	18,300	15,724	18,572	143,697	125,125	....
Cullman	1,000	....						
Etowah	3,080	3,168	5,884	9,578	20,855	93,591	72,736	....
Jefferson	3,729,719	3,714,676	4,204,590	4,878,696	5,255,296	5,549,715	294,419	....
St. Clair	33,368	67,584	72,808	52,252	156,270	140,816	....	15,454
Shelby	52,923	84,673	68,987	86,928	135,832	149,132	13,300	....
Tuscaloosa	205,223	234,488	238,954	325,461	268,422	374,718	106,296	....
Walker	952,642	1,037,516	1,071,334	1,249,294	1,489,380	1,284,025	....	205,355
Winston	2,140	8,238	8,535	[a]28,220	[a]49,863	69,505	19,642	....
Small mines	25,000	35,000	35,000	35,000	35,000	35,000	....	....
Total	5,748,697	5,893,770	6,535,283	7,593,416	8,394,275	9,099,052	[b]704,777	....

[a] Includes product of Marion County.

[b] Net increase.

In the following table is shown the total production of Alabama since 1870, with the value of the product each year since 1886:

Annual coal production of Alabama since 1870.

Year.	Quantity.	Value.	Average price per ton.	Year.	Quantity.	Value.	Average price per ton.
	Short tons.				*Short tons.*		
1870	13,200	....	....	1887	1,950,000	$2,535,000	$1.30
1873	44,800	....	....	1888	2,900,000	3,335,000	1.15
1874	50,400	....	....	1889	3,572,983	3,961,491	1.10
1875	67,200	....	....	1890	4,090,409	4,202,469	1.03
1876	112,000	....	....	1891	4,759,781	5,087,596	1.07
1877	196,000	....	....	1892	5,529,312	5,788,898	1.05
1878	224,000	....	....	1893	5,136,935	5,096,792	.99
1879	280,000	....	....	1894	4,397,178	4,085,535	.93
1880	380,800	....	....	1895	5,693,775	5,126,822	.90
1881	420,000	....	....	1896	5,748,697	5,174,135	.90
1882	896,000	....	....	1897	5,893,770	5,192,085	.88
1883	1,568,000	....	....	1898	6,535,283	4,932,776	.75
1884	2,240,000	....	....	1899	7,593,416	8,256,462	1.09
1885	2,492,000	....	....	1900	8,394,275	9,793,785	1.17
1886	1,800,000	$2,574,000	$1.43	1901	9,099,052	10,000,892	1.10

ALASKA.

As early as 1852 attempts were made by the Russian-American Company to open coal mines at Port Graham, on the western side of Kenai Peninsula. The Russians soon abandoned the enterprise, but the operations induced an American company to develop other mines at Port Chatham. This enterprise, so far as known, lasted for about ten years, but with the development of the better and more economically worked deposits in British Columbia and the State of Washington these operations became unprofitable and were abandoned. In 1868 a small amount of coal was mined by Commander Mitchell, of the United States Navy, from Kootznahoo Inlet, Admiralty Island. In the same year Capt. J. W. Wood, of the United States revenue steamer *Wayanda*, reported coal near Point Gardner, on Admiralty Island. An attempt to mine this coal, which was made some years afterwards, was unsuccessful. In fact, from this time until the close of 1901 spasmodic attempts have been made to mine coal in this Territory, but they so far have not been of long duration. In 1888 the Alaska Coal Company began mining at Kachemak Bay, and this company, together with the Northern Pacific Mining and Transportation Company, continued to mine coal in this vicinity for several years. Since 1899 the Cook Inlet Coal Fields Company has had control of the field, and is now the only concern doing any actual mining in the Territory. In 1893 an attempt was made to mine coal at Chignik River, and operations have since been intermittently carried on by the Alaska Packers'

Association. Some development work has been done by the Admiralty Coal and Fuel Company in the southeastern part of the Territory. The Alaska Mining and Development Company was organized in 1889 to develop coal mines at Herendeen Bay, on the western side of the Alaskan Peninsula, but the Alaska Commercial Company, which afterwards obtained control, does not seem to have made a success of the enterprise. A number of other attempts have been made to mine coal in Alaska, the chief market for which was with the steamers plying along the coast and in the river traffic of the Territory.

The principal development work done in 1901 was by the Cook Inlet Coal Fields Company, at Homer, but the coal produced was obtained only in the way of development, and is included with the production of California.

ARIZONA.

Prof. William P. Blake, of the University of Arizona, at Tucson, is of the opinion that coal beds of workable area can be found in this Territory. In an article in the American Geologist, he writes as follows:

> In the Chiricahua Mountains we find evidences of Coal Measures and vegetation of that period in the shales and uplifted beds of graphitic anthracite several feet thick. So also in the San Carlos region and northwards heavy strata of the Carboniferous occur with seams of coal, but so far as yet determined of limited thickness and value These occurrences are, however, sufficient to show a far western extension of the Carboniferous, and consequently the existence of dry or swamp land at that time. The most western point in the latitude of Arizona at which Coal Measures have before been found was in the Rocky Mountains near Santa Fe. Thickly bedded limestones of dark color and of Carboniferous age occur in the mountains west of Tucson. The limestones in the Quijotoa Mountains at the Vekol lead-silver mines contain an abundance of cyathophylloid corals, and are referred to the Carboniferous. The dark-colored limestones of the Mule Mountains, at Tombstone, and also those at the American mine in the Swisshelms are similarly referred, and are doubtless a part of the extensive series of limestone and shaly beds of the northern portion of Santa Ritas. A portion of the strata of the Whetstone Range and of the Dragoons, and of the Galiuro Mountains, are of the Carboniferous age.

No production has been reported from the Territory.

ARKANSAS.

Total production in 1901, 1,816,136 short tons; spot value, $2,068,613.

The coal fields of Arkansas have been the scenes of greatly increased activity during the last two years. In 1899 the advance of the industry was checked and thrown into a state of almost complete demoralization by labor disturbances. There were during that year 11 mines out of the 22 commercial mines in the State in which all of the men were out for periods ranging from 30 to 180 days. The mines affected by the strike were all among the most important producers, employing 2,195 out of a total of 2,313 men in the State. As a result of these disturbances the production in 1899 dropped to 843,554 short tons, as compared with 1,205,479 short tons in 1898. The State recovered from the demoralized condition in 1900, and the output for that year reached 1,447,945 short tons, the maximum production up to that time. In 1901 the production was again increased 368,191 tons, and reached a total of 1,816,136 short tons, a gain of 25.4 per cent.

During the last two years the demand for Arkansas coal has been unusually stimulated. A part of the product possesses qualities of a somewhat semianthracitic character, which recommend it highly as a domestic fuel, it being almost smokeless. It is being rapidly introduced into cities in the west, where determined efforts are being made to suppress, or at least to reduce, the smoke nuisance.

The mechanical production of coal in Arkansas has evidently not shown satisfactory results. The returns for 1901 show that the same number of machines were employed last year as in 1900, but the machine-mined product decreased from 219,085 tons to 102,220 tons. Of the 20 machines in use last year 15 were employed for only a portion of the time. In one mine in which 10 machines were installed only 6 were in use for about two-thirds of the time. In another mine in which 5 machines had been installed the use of the machines was discontinued in July.

There were no labor troubles reported in Arkansas in 1901, the miners evidently not having forgotten the experience of 1899.

In the following tables are presented the statistics of production in 1900 and 1901, with the distribution of the product by counties and according to consumption:

Coal production in Arkansas in 1900, by counties.

County.	Loaded at mines for shipment.	Sold to local trade and used by employees.	Used at mines for steam and heat.	Total production.	Total value.	Average price per ton.	Average number of days active.	Average number of employees.
	Short tons.	*Short tons.*	*Short tons.*	*Short tons.*				
Johnson	134,372	514	4,250	139,136	$217,222	$1.56	199	311
Sebastian	975,753	1,555	22,171	999,479	1,030,740	1.03	221	1,958
Franklin, Logan, and Pope	286,549	2,881	13,900	303,330	393,656	1.30	222	531
Small mines	....	6,000	....	6,000	12,000	......	......	......
Total	1,396,674	10,950	40,321	1,447,945	1,653,618	1.14	219	2,800

Coal production of Arkansas in 1901, by counties.

County.	Loaded at mines for shipment.	Sold to local trade and used by employees.	Used at mines for steam and heat.	Total production.	Total value.	Average price per ton.	Average number of days active.	Average number of employees.
	Short tons.	*Short tons.*	*Short tons.*	*Short tons.*				
Johnson	140,147	1,140	4,938	146,225	$203,461	$1.39	232	302
Sebastian	1,271,039	2,796	31,355	1,305,190	1,390,995	1.06	214	2,297
Franklin, Logan, and Pope	343,341	1,990	13,390	358,721	462,157	1.29	248	545
Small mines	....	6,000	....	6,000	12,000	......	......	......
Total	1,754,527	11,926	49,683	1,816,136	2,068,613	1.14	223	3,144

Since 1889 the distribution of the Arkansas coal product has been as follows:

Distribution of the coal product of Arkansas from 1889 to 1901, inclusive.

Year.	Loaded at mines for shipment.	Sold to local trade and used by employees.	Used at mines for steam and heat.	Total product.	Total value.	Average price per ton.	Average number of days active.	Average number of employees.
	Short tons.	*Short tons.*	*Short tons.*	*Short tons.*				
1889	268,518	6,820	4,246	279,584	$395,836	$1.42	....	677
1890	374,969	9,240	15,679	399,888	514,595	1.29	214	938
1891	518,120	8,909	15,350	542,379	647,560	1.19	214	1,317
1892	513,908	7,450	14,200	535,558	666,230	1.24	199	1,128
1893	549,504	11,778	13,481	574,763	773,347	1.34	151	1,559
1894	488,077	7,870	16,679	512,626	631,988	1.22	134	1,493
1895	576,112	14,935	7,275	598,322	751,156	1.25	176	1,218
1896	647,240	8,640	19,494	675,374	755,577	1.12	168	1,507
1897	827,518	11,588	18,084	856,190	903,993	1.06	156	1,990
1898	1,167,103	13,256	25,120	1,205,479	1,238,778	1.03	163	2,555
1899	811,366	10,296	21,892	843,554	989,383	1.17	156	2,313
1900	1,396,674	10,950	40,321	1,447,945	1,653,618	1.14	219	2,800
1901	1,754,527	11,926	49,683	1,816,136	2,068,613	1.14	223	3,144

According to the Tenth United States Census the coal product of Arkansas in 1880 was 14,778 short tons, valued at $33,535. No statistics were obtained in 1881. With this exception the statistics of production since 1880 have been as follows:

Annual production of coal in Arkansas since 1880.

[Short tons.]

Year.	Quantity.	Value.	Average price per ton.
1880	14,778	$33,535	....
1882	5,000	....	....
1883	50,000	....	....
1884	75,000	....	....
1885	100,000	....	....
1886	125,000	200,000	$1.60
1887	129,600	194,400	1.50
1888	276,871	415,306	1.50
1889	279,584	395,836	1.42
1890	399,888	514,595	1.29
1891	542,379	647,560	1.19
1892	535,558	666,230	1.24
1893	574,763	773,347	1.34
1894	512,626	631,988	1.22
1895	598,322	751,156	1.25
1896	675,374	755,577	1.12
1897	856,190	903,993	1.06
1898	1,205,479	1,238,778	1.03
1899	843,554	989,383	1.17
1900	1,447,945	1,653,618	1.14
1901	1,816,136	2,068,613	1.14

The production of Arkansas, by counties, with the increases in 1901 as compared with 1900, are shown in the following table:

Coal production of Arkansas since 1896, by counties.

[Short tons.]

County	1896.	1897.	1898.	1899.	1900.	1901.	Increase, 1901.
Franklin Johnson Pope	222,711	281,299	328,412	[a]257,196	[a]442,466	504,946	62,480
Sebastian	446,663	568,891	871,067	580,358	999,479	1,305,190	305,711
Small mines	6,000	6,000	6,000	6,000	6,000	6,000	....
Total	675,374	856,190	1,205,479	843,554	1,447,945	1,816,136	368,191

[a] Includes also product of Logan County.

CALIFORNIA.

Total production in 1901, 151,079 short tons; spot value, $394,106.

As in preceding years, the production of coal in California in 1901 was principally from Alameda, Amador, and Contra Costa counties, though from some interesting developments in Kern County, the discovery of which was referred to in this report for 1900, promises are held out that the southern portion of the State will assume some importance as a coal producer in the future. It is reported that bituminous coal of good quality has been opened up in the vicinity of Randsburg, and that the Randsburg Railroad Company will build an extension to this new district. It is probable that even without the bringing in of this new field the coal output in California in 1901 would have exceeded that of 1900 had not the extraordinary development of the oil fields of the State induced larger consumption of this product as a fuel in competition with coal. As it was the production of the State fell off from 171,708 short tons, valued at $523,231, in 1900 to 151,079 tons, valued at $394,106, the decrease being 20,629 short tons, or 12 per cent, in amount, and $129,125, or nearly 25 per cent, in value. This larger decrease in value was, in turn, due to the increased competition of oil. The average price per ton for coal in the State declined from $3.05 in 1900 to $2.60 in 1901. As previously stated in the Coal Trade Review, the receipts of coal in California, as reported by Mr. J. W. Harrison, decreased from 1,889,128 tons in 1900 to 1,834,785 tons in 1901. Mr. Harrison states that coal is being gradually eliminated as a fuel for locomotives and that all the power houses for cable roads in San Francisco are now using oil. He attributes the fact that the coal consumption of California in 1901 did not show any larger decrease to the large amount which was necessary for the coaling of transports and other vessels for the United States Army and Navy in its conduct of the military and naval operations in the Philippine Islands.

The details of the production in the State in 1900 and 1901 are shown in the following tables:

Coal production of California in 1900, by counties.

County.	Loaded at mines for shipment.	Sold to local trade and used by employees.	Used at mines for steam and heat.	Total production.	Total value.	Average price per ton.	Average number of days active.	Average number of employees.
	Short tons.	*Short tons.*	*Short tons.*	*Short tons.*				
Alameda, Amador, and Contra Costa	158,508	50	6,650	165,208	$505,981	$3.06	312	360
Orange and Riverside	2,000	4,500	....	6,500	17,250	2.65	245	18
Total	160,508	4,550	6,650	171,708	523,231	3.05	309	378

Coal production of California in 1901, by counties.

County.	Loaded at mines for shipment.	Sold to local trade and used by employees.	Used at mines for steam and heat.	Total production.	Total value.	Average price per ton.	Average number of days active.	Average number of employees.
	Short tons.	*Short tons.*	*Short tons.*	*Short tons.*				
Alameda, Amador, Contra Costa, and Kern	129,766	97	17,916	147,779	$385,856	$2.61	292	419
Orange and Riverside	2,800	500	....	3,300	8,250	2.50	148	9
Total	132,566	597	17,916	151,079	394,106	2.60	289	428

The distribution of the product for consumption since 1889 and the total production since 1883 are as follows:

Distribution of the coal product of California from 1889 to 1901, inclusive.

Year.	Loaded at mines for shipment.	Sold to local trade and used by employees.	Used at mines for steam and heat.	Total product.	Total value.	Average price per ton.	Average number of days active.	Average number of employees.
	Short tons.	*Short tons.*	*Short tons.*	*Short tons.*				
1889	111,128	3,146	7,546	121,820	$288,232	$2.37	....	....
1890	103,436	2,121	5,154	110,711	283,019	2.56	301	364
1891	86,783	3,424	3,094	93,301	204,902	2.20	222	256
1892	73,269	9,679	2,230	85,178	209,711	2.46	204	187
1893	64,733	5,336	2,534	72,603	167,555	2.31	208	158
1894	52,736	8,143	6,368	67,247	155,620	2.31	232	125
1895	60,440	12,171	2,842	75,453	175,778	2.33	262	190
1896	69,608	4,537	4,399	78,544	166,123	2.12	297	157
1897	74,762	6,869	4,361	85,992	201,236	2.34	150	363
1898	123,568	15,996	4,724	144,288	349,915	2.43	265	284
1899	151,041	5,242	4,432	160,715	428,333	2.67	291	363
1900	160,508	4,550	6,650	171,708	523,231	3.05	309	378
1901	132,566	597	17,916	151,079	394,106	2.60	289	428

Coal production of California since 1883.

Year.	Quantity.	Value.	Average price per ton.	Year.	Quantity.	Value.	Average price per ton.
	Short tons.				*Short tons.*		
1883	76,162	....	....	1893	72,603	$167,555	$2.31
1884	77,485	....	....	1894	67,247	155,620	2.31
1885	71,615	....	....	1895	75,453	175,778	2.33
1886	100,000	$300,000	$3.00	1896	78,544	166,123	2.12
1887	50,000	150,000	3.00	1897	85,992	201,236	2.34
1888	95,000	380,000	4.00	1898	144,288	349,915	2.43
1889	121,820	288,232	2.36	1899	160,715	428,333	2.67
1890	110,711	283,019	2.56	1900	171,708	523,231	3.05
1891	93,301	204,902	2.20	1901	151,079	394,106	2.60
1892	85,178	209,711	2.46				

COLORADO.

Total production in 1901, 5,700,015 short tons; spot value, $6,441,891.

Colorado ranks first among the coal-producing States west of the Mississippi River and seventh among all the States. The output has increased each year since 1894. As compared with 1900, the output in 1901 increased 455,651 short tons, or 8.7 per cent. The value increased in the same proportion, from $5,858,036 to $6,441,891, a net gain of $583,855. The increased production in Colorado in 1901 has been principally due to the increased activity in the iron industry of the State. The building of the extensive works of the Colorado Fuel and Iron Company at Minnequa, near Pueblo, will doubtless be reflected in a still further increase of production for the current year. The principal new developments during 1901 were in the coal fields in the vicinity of Colorado Springs. This field promises to be one of considerable importance to the State.

The average price per ton has remained fairly steady for the last three years.

Details of production by counties for the last two years, with the distribution of the product for consumption, the statistics of labor employed, and the average number of days worked, are presented in the following tables:

Coal production of Colorado in 1900, by counties.

County.	Loaded at mines for shipment.	Sold to local trade and used by employees.	Used at mines for steam and heat.	Made into coke.	Total production.	Total value.	Average price per ton.	Average number of days active.	Average number of employees.
	Short tons.	*Short tons.*	*Short tons.*	*Short tons.*	*Short tons.*				
Boulder	529,729	15,334	29,271	....	574,334	$773,876	$1.35	266	637
Delta	200	5,060	157	....	5,417	7,396	1.37	187	14
El Paso	76,934	16,000	1,400	....	94,334	109,294	1.16	192	200
Fremont	588,951	2,152	28,310	....	619,413	1,029,237	1.66	225	1,097
Garfield	137,982	1,661	1,516	....	141,159	152,603	1.08	246	177
Gunnison	295,654	2,653	11,494	122,754	432,555	589,592	1.36	289	479
Huerfano	824,466	3,858	26,620	....	854,944	912,110	1.07	287	1,115
La Plata	111,923	10,657	144	800	123,524	177,486	1.44	207	220
Las Animas	1,320,373	19,740	34,076	749,222	2,123,411	1,808,936	.85	283	3,098
Pitkin	74,500	731	2,997	97,714	175,942	162,474	.92	222	236
Routt	....	1,375	....	....	1,375	2,256	1.64	70	13
Weld	57,910	19,175	2,930	....	80,015	103,489	1.29	199	133
Arapahoe and Larimer	....	5,040	....	....	5,040	8,050	1.60	206	13
Jefferson and Rio Blanco	2,250	1,491	170	....	3,911	5,872	1.50	250	8
Mesa, Montezuma, and Montrose	7,000	1,990	....	....	8,990	15,305	1.70	250	19
Total	4,027,872	106,917	139,085	970,490	5,244,364	5,858,036	1.12	264	7,459

Coal production of Colorado in 1901, by counties.

County.	Loaded at mines for shipment.	Sold to local trade and used by employees.	Used at mines for steam and heat.	Made into coke.	Total production.	Total value.	Average price per ton.	Average number of days active.	Average number of employees.
	Short tons.	*Short tons.*	*Short tons.*	*Short tons.*	*Short tons.*				
Boulder	432,942	18,896	31,137	....	482,975	$611,151	$1.27	221	1,133
Delta	2,410	3,284	150	....	5,844	8,036	1.38	183	11
El Paso	170,979	700	4,300	....	175,979	252,245	1.43	301	196
Fremont	508,170	4,591	17,226	6,326	536,313	890,155	1.66	234	1,046
Garfield	165,163	2,294	6,250	....	173,707	190,547	1.10	238	247
Gunnison	273,666	3,288	7,826	112,263	397,043	608,230	1.53	251	547
Huerfano	888,288	5,128	25,193	....	918,609	1,063,403	1.16	250	1,319
La Plata	133,214	9,513	512	1,653	144,892	219,021	1.51	255	222
Las Animas	1,594,414	20,986	59,630	801,108	2,476,138	2,197,567	.89	272	3,598
Pitkin	143,632	1,258	2,485	178,497	325,872	304,692	.93	233	436
Rontt	140	1,418	....	....	1,558	2,562	1.64	55	13
Weld	11,667	18,857	2,850	....	33,374	53,616	1.61	263	48
Arapahoe and Larimer	....	608	....	....	608	760	1.25	100	4
Jefferson and Rio Blanco, Mesa, Montezuma, and Montrose	25,600	1,483	20	....	27,103	39,906	1.47	141	50
Total	4,350,285	92,304	157,579	1,099,847	5,700,015	6,441,891	1.13	253	8,870

A résumé of the production, with the distribution of the product in Colorado since 1899, is shown in the following table:

Distribution of the coal product of Colorado from 1889 to 1901, inclusive.

Year.	Loaded at mines for shipment.	Sold to local trade and used by employees.	Used at mines for steam and heat.	Made into coke.	Total product.	Total value.	Average price per ton.	Average number of days active.	Average number of employees.
	Short tons.	*Short tons.*	*Short tons.*	*Short tons.*	*Short tons.*				
1889	2,109,335	91,248	88,537	308,061	2,597,181	$3,993,768	$1.54	....	4,904
1890	2,636,939	65,432	48,451	343,181	3,094,003	4,344,196	1.40	....	5,827
1891	2,934,332	70,000	50,000	458,300	3,512,632	4,800,000	1.37	....	6,000
1892	2,938,980	126,748	55,721	389,381	3,510,830	5,685,112	1.62	229	5,747
1893	3,345,951	65,386	178,993	512,059	4,102,389	5,104,602	1.24	188	7,202
1894	2,181,048	56,688	112,414	481,259	2,831,409	3,516,340	1.24	155	6,507
1895	2,415,578	49,088	99,055	489,261	3,082,982	3,675,185	1.20	182	6,125
1896	2,424,027	65,755	93,128	529,490	3,112,400	3,606,642	1.16	172	6,704
1897	2,649,042	76,699	93,782	542,180	3,361,703	3,947,186	1.17	180	5,852
1898	3,132,676	130,305	117,820	695,546	4,076,347	4,686,081	1.15	220	6,440
1899	3,681,341	118,153	106,988	869,742	4,776,224	5,363,667	1.12	246	7,166
1900	4,027,872	106,917	139,085	970,490	5,244,364	5,858,036	1.12	264	7,459
1901	4,350,285	92,304	157,579	1,099,847	5,700,015	6,441,891	1.13	253	8,870

The production by counties for the last six years, with the increases and decreases in 1901 as compared with 1900, have been as follows:

Coal production of Colorado since 1896, by counties.

[Short tons.]

County.	1896.	1897.	1898.	1899.	1900.	1901.	Increase, 1901.	Decrease 1901.
Boulder	448,706	477,790	451,539	540,475	574,334	482,975	....	91,359
Fremont	294.822	304,589	426,553	620,609	619,413	536,313	....	83,100
Garfield	165,797	182,884	222,480	134,354	141,159	173,707	32,548	....
Gunnison	260,596	297,417	323,321	319,434	432,555	397,043	....	35,512
Huerfano	353,338	367,894	1,075,881	632,577	854,944	918,609	63,665	....
Jefferson	....	10,445	12,366	9,900	3,000	....	....	3,000
Las Animas	1,261,555	1,427,526	1,211,340	2,125,143	2,123,411	2,476,138	352,727	....
La Plata	104,661	76,788	100,650	116,500	123,524	144,892	21,368	....
Pitkin	168,413	171,111	195,496	172,917	175,942	325,872	149,930	....
Weld	4,300	8,310	24,085	47,573	80,015	33,374	....	46,641
Other counties	50,212	36,949	32,636	56,742	[a] 116,067	[b] 211,092	95,025	....
Total	3,112,400	3,361,703	4,076,347	4,776,224	5,244,364	5,700,015	[c] 455,651	....

[a] Of this amount El Paso County produced 94,334 tons.

[b] Of this amount El Paso County produced 175,979 tons.

[c] Net increase.

The first coal mines opened in the State, so far as known, began operations in 1864, the total output in that year being 500 tons. The growth of the industry since that time is presented in the following statement:

Coal production of Colorado since 1864.

[Short tons.]

Year.	Quantity.	Year.	Quantity.
1864	500	1883	1,229,593
1865	1,200	1884	1,130,024
1866	6,400	1885	1,356,062
1867	17,000	1886	1,368,338
1868	10,500	1887	1,791,735
1869	8,000	1888	2,185,477
1870	13,500	1889	2,597,181
1871	15,600	1890	3,077,003
1872	68,540	1891	3,512,632
1873	69,997	1892	3,510,830
1874	77,372	1893	4,102,389
1875	98,838	1894	2,831,409
1876	117,666	1895	3,082,982
1877	160,000	1896	3,112,400
1878	200,630	1897	3,361,703
1879	322,732	1898	4,076,347
1880	437,005	1899	4,776,224
1881	706,744	1900	5,244,364
1882	1,061,479	1901	5,700.015

GEORGIA.

Total production in 1901, 342,825 short tons; spot value, $411.685.

There are only two counties in Georgia, Dade and Walker, in which coal seams of workable thickness and quality have been exploited. These counties are in the northwestern corner of the State, and belong to the great Appalachian system, being a development, in this section, of the Warrior coal field of Alabama. The coal bears an excellent reputation as a steam-raising fuel, and is in good demand for bunker coal at Southern ports. It also makes a good grade of coke, which is sold to blast furnaces in the vicinity of Chattanooga.

The production in 1901 exceeded that of the preceding year by 27,268 short tons, or 8.6 per cent. The value increased somewhat more in proportion, from $370,022 to $411,685, a gain of $41,663. The average price per ton advanced from $1.17 to $1.20, the latter figure being the highest reported since 1891.

A large percentage of the miners engaged in the production of coal in Georgia are State convicts, leased from the State authorities, and as their efficiency is apt to vary from year to year the labor statistics of Georgia are hardly comparable with those of other States. From 75 to 80 per cent of the labor employed in the coal mines of the State is convict labor.

The statistics of production during the last thirteen years are shown in the following table:

Coal production of Georgia since 1889.

Year.	Loaded at mines for shipment.	Sold to local trade and used by employees.	Used at mines for steam and heat.	Made into coke.	Total production.	Total value.	Average price per ton.	Average number of days active.	Average number of employees.
	Short tons.	*Short tons.*	*Short tons.*	*Short tons.*	*Short tons.*				
1889	46,131	158	15,000	164,645	225,934	$338,901	$1.50	....	....
1890	57,949	....	....	170,388	228,337	238,315	1.04	313	425
1891	15,000	1,000	5,000	150,000	171,000	256,500	1.50	312	850
1892	52,614	250	3,756	158,878	215,498	212,761	.99	277	467
1893	196,227	....	4,869	171,644	372,740	365,972	.98	342	736
1894	178,610	....	8,978	166,523	354,111	299,290	.85	304	729
1895	135,692	150	6,256	118,900	260,998	215,863	.83	312	848
1896	120,496	875	7,520	109,655	238,546	168,050	.70	303	713
1897	120,398	1,481	5,500	68,490	195,869	140,466	.72	304	469
1898	135,926	890	5,650	101,721	244,187	198,169	.81	298	504
1899	149,954	440	6,150	76,567	233,111	233,344	1.00	302	567
1900	160,889	1,305	6,895	146,468	315,557	370,022	1.17	278	597
1901	249,581	550	1,950	90,764	342,825	411,685	1.20	291	766

Since 1884 the total production has been as follows:

Coal production of Georgia since 1884.

[Short tons.]

Year.	Quantity.	Year.	Quantity.
1884	150,000	1893	372,740
1885	150,000	1894	354,111
1886	223,000	1895	260,998
1887	313,715	1896	238,546
1888	180,000	1897	195,869
1889	225,934	1898	244,187
1890	228,337	1899	233,111
1891	171,000	1900	315,557
1892	215,498	1901	342,825

IDAHO.

Attempts have been made a number of times to mine coal in Idaho, but they have not met with success. A small amount has been produced at Horseshoe Bend, in Boise County, which was sold to ranchmen in the vicinity, but no product even of this nature was reported in 1901.

ILLINOIS.

Total production in 1901, 27,331,552 short tons; spot value, $28,163,937.

Previous to 1899 statistics of coal production in Illinois were obtained from the reports of the Bureau of Labor Statistics. The State reports, however, are collected for the fiscal year ending June 30, and in order that the figures for Illinois might be made uniform in this report with those of the other coal-producing States they have been compiled during the last few years from direct returns from the operators to the Survey. With few exceptions the coal operators of Illinois have responded cordially to the requests of this office. In the few instances where operators have failed to report the figures have been obtained from the State bureau of statistics, and the writer desires to express the proper acknowledgments to Mr. David Ross, secretary of the bureau, for furnishing these figures in advance of the publication of his own report.

Illinois continues to hold second place among the coal-producing States, notwithstanding the rapid advances which West Virginia has been making in the last few years, and which threatened to overtake Illinois with the beginning of the new century.

In 1900 Illinois produced a total of 25,767,981 short tons, valued at $26,927,185. compared with which the production in 1901 shows an increase of 1,563,571 short tons, or 6 per cent in amount, and $1,236,752, or 4.5 per cent in value. The average price per ton for the State declined 1 cent, from $1.04 to $1.03.

The statistics of production in Illinois for the calendar years 1900 and 1901, as reported to the Geological Survey, are presented in the following tables:

Coal production of Illinois in 1900, by counties.

County.	Loaded at mines for shipment.	Sold to local trade and used by employees.	Used at mines for steam and heat.	Total production.	Total value.	Average price per ton.	Average number of days active.	Average number of employees.
	Short tons.	*Short tons.*	*Short tons.*	*Short tons.*				
Bond	150,000	....	....	150,000	$135,000	$0.90	250	200
Bureau	1,216,790	56,130	45,864	1,318,784	1,898,190	1.44	218	3,538
Calhoun	....	6,300	....	6,300	6,678	1.06	261	24
Christian	527,301	63,288	31,594	622,183	614,764	.99	162	1,056
Clinton	490,468	11,871	29,118	531,457	493,362	.93	242	614
Fulton	578,039	11,624	12,982	602,645	742,242	1.23	193	1,072
Gallatin	....	5,944	25	5,969	5,875	.98	217	9
Greene	....	5,220	....	5,220	7,830	1.50	139	26
Grundy	1,245,570	40,461	29,657	1,315,688	1,790,013	1.36	267	2,985
Hancock	1,255	12	....	1,267	1,901	1.50	80	15
Henry	12,567	58,352	1,127	72,046	130,721	1.81	202	216
Jackson	889,202	50,480	46,316	985,998	997,507	1.01	207	1,133
Jefferson	48,648	....	....	48,648	44,229	.91	280	64
Johnson	600	1,150	10	1,760	1,948	1.11	137	9
Kankakee	99,054	4,828	5,247	109,129	109,129	1.00	175	250
Knox	23,890	38,225	308	62,423	93,530	1.50	164	175
Lasalle	1,772,534	165,768	84,160	2,022,462	2,521,623	1.25	255	3,462
Livingston	178,119	50,760	7,993	236,872	305,669	1.29	217	440
Logan	102,651	53,890	360	156,901	177,257	1.13	226	229
McDonough	28,806	987	500	30,293	45,495	1.50	172	142
McLean	131,855	63,543	11,906	207,304	263,235	1.27	280	407
Macon	22,925	35,100	....	58,025	113,729	1.96	175	263
Macoupin	1,884,677	45,649	82,214	2,012,540	1,872,875	.93	226	2,253
Madison	1,376,152	75,925	58,317	1,510,394	1,151,956	.77	233	1,600
Marion	595,945	172,663	37,251	805,859	747,743	.93	245	1,039
Marshall	363,189	20,772	12,126	396,087	506,673	1.28	273	810
Menard	330,947	43,332	22,798	397,077	406,131	1.02	200	547
Mercer	522,841	27,864	13,542	564,247	640,207	1.13	268	815
Montgomery	270,200	23,700	10,300	304,200	282,560	.93	184	445
Morgan	....	4,444	56	4,500	6,750	1.50	199	14
Peoria	632,322	70,057	15,560	717,939	802,020	1.12	214	1,095
Perry	503,308	43,915	13,868	561,091	494,246	.88	197	1,029
Randolph	443,613	15,440	7,494	466,547	390,510	.80	213	612
Rock Island	12,791	30,805	482	44,078	70,681	1.60	191	120
St. Clair	2,079,496	103,543	49,747	2,232,786	1,753,862	.79	215	2,643
Saline	107,676	6,964	2,010	116,650	87,649	.75	203	227
Sangamon	2,501,853	168,451	68,098	2,738,402	2,883,806	1.05	221	3,417
Schuyler	3,744	1,248	....	4,992	5,997	1.20	214	12
Scott	21,500	4,797	800	27,097	37,080	1.37	279	58
Shelby	80,435	20,450	8,507	109,392	124,712	1.14	218	195
Stark	....	14,691	500	15,191	23,190	1.53	163	44
Tazewell	58,560	32,268	2,015	92,843	106,715	1.15	197	194
Vermilion	1,968,735	133,284	37,455	2,139,474	2,151,308	1.01	225	2,892
Warren	1,000	10,919	100	12,019	19,636	1.63	198	34
Washington	20,000	15,610	1,681	37,291	36,635	.98	166	79
Will	45,113	7,400	2,810	55,323	94,640	1.71	212	158
Williamson	1,444,951	20,017	43,485	1,508,453	1,279,024	.85	228	2,006
Woodford	166,415	14,743	10,977	192,135	300,652	1.56	249	437
Small mines	....	150,000	....	150,000	150,000	.....	....	....
Total	22,955,737	2,002,884	809,360	25,767,981	26,927,185	1.04	226	39,101

Coal production of Illinois in 1901, by counties.

County.	Loaded at mines for shipment.	Sold to local trade and used by employees.	Used at mines for steam and heat.	Total production.	Total value.	Average price per ton.	Average number of days active.	Average number of employees.
	Short tons.	*Short tons.*	*Short tons.*	*Short tons.*				
Bond	151,000	500	250	151,750	$136,750	$0.90	284	259
Bureau	1,487,358	58,141	49,304	1,594,803	1,854,306	1.16	252	3,303
Calhoun	....	4,985	938	5,923	7,699	1.30	286	21
Christian	510,248	73,275	32,850	616,373	583,573	.95	161	971
Clinton	689,301	50,848	24,911	765,060	602,066	.79	220	902
Fulton	617,912	22,625	13,879	654,416	723,644	1.11	210	1,082
Gallatin	....	4,800	....	4,800	5,200	1.08	186	9
Greene	1,120	2,660	28	3,808	5,208	1.37	232	15
Grundy	1,192,231	44,350	33,160	1,269,741	1,950,703	1.52	222	3,276
Hancock	5,200	906	....	6,106	9,350	1.54	207	16
Henry	13,565	71,714	4,186	89,465	153,202	1.71	202	231
Jackson	753,780	69,349	46,964	870,093	907,879	1.04	189	1,099
Jefferson	50,000	....	....	50,000	65,000	1.30	250	60
Johnson	....	1,000	10	1,010	1,010	1.00	150	5
Kankakee	56,067	3,605	7,523	67,195	93,325	1.39	233	178
Knox	33,611	44,533	492	78,636	107,171	1.36	202	189
Lasalle	1,503,515	193,739	54,504	1,751,758	2,451,927	1.40	248	3,370
Livingston	231,041	65,103	11,123	307,267	383,257	1.25	224	576
Logan	107,046	36,910	17,655	161,611	205,494	1.27	196	285
McDonough	25,835	5,427	75	31,337	46,319	1.48	164	127
McLean	57,239	74,340	13,380	144,959	202,939	1.40	287	333
Macon	38,429	48,039	....	86,468	153,602	1.78	291	305
Macoupin	1,815,414	63,076	81,548	1,960,038	1,695,878	.87	207	2,406
Madison	1,776,785	65,394	69,202	1,911.381	1,537,813	.80	241	2,132
Marion	765,889	40,476	38,451	844,816	736,424	.87	236	1,042
Marshall	388,943	15,487	13,014	417,444	544,631	1.30	244	825
Menard	327,997	43,560	19,374	390,931	425,511	1.09	215	525
Mercer	523,741	28,276	11,333	563,350	750,196	1.33	235	843
Montgomery	313,000	41,972	12,354	367,326	332,185	.90	224	510
Morgan	....	3,000	....	3,000	4,500	1.50	100	10
Peoria	603,839	42,815	13,047	659,701	706,765	1.07	206	1,001
Perry	598,753	23,700	9,586	632,039	575,142	.90	177	1,151
Randolph	336,337	19,904	12,710	368,951	284,295	.77	170	617
Rock Island	19,059	48,179	1,118	68,356	100,660	1.47	157	179
St. Clair	2,049,812	174,524	74,507	2,298,843	1,872,575	.81	223	2,613
Saline	152,671	9,913	1,000	163,584	161,607	.99	197	222
Sangamon	3,013,193	166,062	98,684	3,277,939	3,100,868	.95	231	4,083
Schuyler	....	5,400	152	5,552	6,494	1.17	212	13
Scott	18,500	4,580	600	23,680	33,775	1.43	267	61
Shelby	90,150	20,542	3,500	114,192	138,944	1.22	240	180
Stark	....	13,100	300	13,400	21,250	1.59	197	43
Tazewell	64,639	77,992	2,938	145,569	161,782	1.11	198	283
Vermilion	2,074,258	144,160	42,546	2,260,964	2,294,690	1.01	215	3,106
Warren	1,088	9,112	100	10,300	15,428	1.50	171	39
Washington	20,000	4,600	1,100	25,700	21,200	.82	190	54
Will	41,981	13,205	1,460	56,646	83,413	1.47	229	164
Williamson	1,652,800	37,808	52,444	1,743,052	1,553,740	.89	187	2,729
Woodford	122,514	12,658	7,047	142,219	204,547	1.44	193	437
Small mines	....	150,000	....	150,000	150,000	......	......	......
Total	24,295,861	2,156,344	879,347	27,331,552	28,163,937	1.03	220	41,880

In the following table is shown the total output, by counties, during the last five years, with the increases and decreases in 1901 as compared with 1900.

Coal production of Illinois in 1897, 1898, 1899, 1900, and 1901, by counties.

County.	1897.	1898.	1899.	1900.	1901.	Increase, 1901.	Decrease, 1901.
	Short tons.	*Short tons.*	*Short tons.*	*Short tons.*	*Short tons.*	*Short tons.*	*Short tons.*
Bond	104,256	96,314	100,955	150,000	151,750	1,750	....
Brown	1,760	1,940	2,630	....	....	....	....
Bureau	1,145,312	865,892	1,400,908	1,318,784	1,594,803	276,019	....
Calhoun	3,868	4,893	6,113	6,300	5,923	....	377
Cass	4,536	2,900	3,430	....	....	....	....
Christian	837,897	495,616	617,027	622,183	616,373	....	5,810
Clinton	328,184	417,584	577,454	531,457	765,060	233,603	....
Fulton	469,034	563,397	651,694	602,645	654,416	51,771	....
Gallatin	19,945	16,812	16,836	5,969	4,800	....	1,169
Greene	7,200	8,520	15,420	5,220	3,808	....	1,412
Grundy	1,077,576	796,249	1,257,092	1,315,688	1,269,741	....	45,947
Hamilton	760	4,882	640	....	....	....	....
Hancock	4,160	5,600	5,498	1,267	6,106	4,839	....
Henry	119,497	159,049	92,429	72,046	89,465	17,419	....
Jackson	675,212	911,194	808,340	985,998	870,093	....	115,905
Jefferson	51,355	46,060	63,010	48,648	50,000	1,352	....
Jersey	....	1,680	4,050	....	....	....	....
Johnson	2,778	2,030	3,541	1,760	1,010	....	750
Kankakee	180,683	84,632	129,262	109,129	67,195	....	41,934
Knox	41,773	49,819	55,924	62,423	78,636	16,213	....
Lasalle	1,508,833	1,165,490	2,015,304	2,022,462	1,751,758	....	270,704
Livingston	145,206	122,087	129,484	236,872	307,267	70,395	....
Logan	168,917	177,935	185,480	156,901	161,611	4,710	....
McDonough	40,532	77,696	42,269	30,293	31,337	1,044	....
McLean	153,334	171,594	186,487	207,304	144,959	....	62,345
Macon	173,163	300,264	150,403	58,025	86,468	28,443	....
Macoupin	1,975,981	1,264,926	1,727,102	2,012,540	1,960,038	....	52,502
Madison	780,921	630,769	1,538,049	1,510,394	1,911,381	400,987	....
Marion	626,850	714,513	710,487	805,859	844,816	38,957	....
Marshall	339,820	286,365	350,732	396,087	417,444	21,357	....
Menard	328,920	314,160	432,948	397,077	390,931	....	6,146
Mercer	425,518	384,345	503,474	564,247	563,350	....	897
Montgomery	251,249	294,667	301,424	304,200	367,326	63,126	....
Morgan	....	1,800	4,506	4,500	3,000	....	1,500
Peoria	504,309	640,193	792,239	717,939	659,701	....	58,238
Perry	689,921	845,329	809,425	561,091	632,039	70,948	....
Randolph	150,647	274,072	437,034	466,547	368,951	....	97,596
Rock Island	35,651	47,490	44,005	44,078	68,356	24,278	....
St. Clair	1,718,194	1,600,752	2,079,353	2,232,786	2,298,843	66,057	....
Saline	51,689	100,005	95,736	116,650	163,584	46,934	....
Sangamon	1,838,453	1,763,863	2,289,708	2,738,402	3,277,939	539,537	....
Schuyler	7,841	11,149	15,874	4,992	5,552	560	....
Scott	25,125	21,337	22,227	27,097	23,680	....	3,417
Shelby	69,329	68,388	105,409	109,392	114,192	4,800	....
Stark	19,472	21,936	25.430	15,191	13,400	....	1,791
Tazewell	86,669	84,507	98,092	92,843	145,569	52,726	....
Vermilion	2,000,623	1,520,699	2,191,067	2,139,474	2,260,964	121,490	....

Coal production of Illinois in 1897, 1898, 1899, 1900, and 1901, by counties—Continued.

County.	1897.	1898.	1899.	1900.	1901.	Increase, 1901.	Decrease, 1901.
	Short tons.	*Short tons.*	*Short tons.*	*Short tons.*	*Short tons.*	*Short tons.*	*Short tons.*
Warren	10,099	12,245	16,992	12,019	10,300	....	1,719
Washington	25,715	43,808	32,360	37,291	25,700	....	11,591
Will	25,682	40,904	42,275	55,323	56,646	1,323	....
Williamson	669,480	915,108	1,072,367	1,508,453	1,743,052	234,599	....
Woodford	148,829	145,840	179,024	192,135	142,219	....	49,916
Small mines	....	....	....	150,000	150,000	....	....
Total	20,072,758	18,599,299	24,439,019	25,767,981	27,331,552	[a]1,563,571	....

[a] Net increase.

The distribution of the product for consumption since 1889 is shown in the following table:

Distribution of the coal product of Illinois from 1889 to 1901, inclusive.

Year.	Loaded at mines for shipment.	Sold to local trade and used by employees.	Used at mines for steam and heat.	Made into coke at the mines.	Total product.	Total value.	Average price per ton.	Average number of days active.	Average number of employees.
	Short tons.	*Short tons.*	*Short tons.*	*Short tons.*	*Short tons.*				
1889	9,884,883	1,810,702	395,787	12,900	12,104,272	$11,755,203	$0.97	....	....
1890	12,539,784	2,130,539	606,497	15,600	15,292,420	14,171,230	.93	204	28,574
1891	12,787,993	2,246,705	610,000	16,000	15,660,698	14,237,074	.91	216	32,951
1892	14,557,655	2,624,821	675,000	4,800	17,862,276	16,243,645	.91	220	34,585
1893	16,260,463	2,931,846	753,955	3,300	19,949,564	17,827,595	.89	229	35,390
1894	13,948,910	2,590,414	570,452	3,800	17,113,576	15,282,111	.89	183	38,477
1895	14,456,524	2,684,607	591,133	3,600	17,735,864	14,239,157	.80	182	38,630
1896	16,128,103	2,995,022	659,601	3,900	19,786,626	15,809,736	.80	186	33,054
1897	16,358,221	3,041,712	669,012	3,813	20,072,758	14,472,529	.72	185	33,788
1898	15,596,888	2,149,808	852,603	....	18,599,299	14,567,598	.78	175	35,026
1899	21,871,930	1,936,515	630,574	....	24,439,019	20,744,553	.85	228	36,756
1900	22,955,737	2,002,884	809,360	....	25,767,981	26,927,185	1.04	226	39,101
1901	24,295,861	2,156,344	879,347	....	27,331,552	28,163,937	1.03	220	41,880

INDIANA.

Total production in 1901, 6,918,225 short tons; spot value, $7,017,143.

The steady increase in production of coal in Indiana, which was noted in the report for 1900, continued through 1901. It has shown an uninterrupted growth since 1896. The production in 1900 exceeded that of 1899 by 477,563 short tons, and was followed by a further increase in 1901 of 434,139 short tons, or 6.6 per cent. The production last year was a little more than double that of 1894, seven years before.

The coal-producing counties of Indiana are all in the western and southwestern part of the State, and form a portion of the central coal field, whose entire development is in Illinois, western Indiana, and a few counties in western Kentucky. The area in Indiana is only a little more than one-sixth of that of Illinois, but the production of the State is more than one-fourth of that of her western neighbor. The principal producing counties in the State are Clay and Vigo, whose combined production amounts to one-third of the total. Both of these counties exceeded 1,000,000 tons during the last three years. Greene and Sullivan counties each exceeded 900,000 tons in 1901, and Parke and Vermilion counties each exceeded 600,000 tons last year and for the two preceding years.

In the following tables are shown the details of production in 1900 and 1901, by counties, and the distribution of the product for consumption, with the statistics of labor employed, number of days worked, etc.

Coal production of Indiana in 1900, by counties.

County.	Loaded at mines for shipment.	Sold to local trade and used by employees.	Used at mines for steam and heat.	Made into coke.	Total production.	Total value.	Average price per ton.	Average number of days active.	Average number of employees.
	Short tons.	*Short tons.*	*Short tons.*	*Short tons.*	*Short tons.*				
Clay	1,122,546	11,462	31,294	....	1,165,302	$1,503,802	$1.29	192	2,780
Daviess and Martin	252,825	19,650	4,150	....	276,625	301,674	1.09	221	550
Fountain	43,600	232	400	....	44,232	53,990	1.22	286	105
Gibson	48,063	14,826	4,000	....	66,889	62,223	.93	187	125
Greene	706,892	10,102	6,261	....	723,255	721,667	1.00	186	1,305
Knox	40,654	17,445	2,650	....	60,749	66,164	1.09	192	125
Parke	612,258	20,228	17,179	....	649,665	794,928	1.22	181	1,447
Perry	4,984	18,843	250	....	24,077	27,867	1.16	202	53
Pike	234,716	3,650	4,462	2,605	245,433	223,203	.91	161	606
Spencer	273	8,833	....	....	9,106	10,970	1.20	151	29
Sullivan	892,314	15,240	32,435	....	939,989	812,213	.86	210	1,274
Vanderburg	44.734	133,379	14,419	....	192,532	216,928	1.13	225	361
Vermilion	646,713	562	2,250	....	649,525	559,691	.86	209	994
Vigo	1,081,540	36,597	33,506	....	1,151,643	1,057,181	.92	217	1,640
Warrick	215,350	25,899	7,815	....	249,064	238,636	.96	204	326
Small mines	....	36,000	....	....	36,000	36,000	......	....	....
Total	5,947,462	372,948	161,071	2,605	6,484,086	6,687,137	1.03	199	11,720

Coal production of Indiana in 1901 by counties.

County.	Loaded at mines for shipment.	Sold to local trade and used by employees.	Used at mines for steam and heat.	Total production.	Total value.	Average price per ton.	Average number of days active.	Average number of employees.
	Short tons.	*Short tons.*	*Short tons.*	*Short tons.*				
Clay	1,044,630	10,447	25,087	1,080,164	$1,445,964	$1.34	179	2,981
Daviess and Martin	212,001	24,480	2,218	238,699	274,241	1.15	184	637
Fountain	34,126	....	700	34,826	34,826	1.00	300	60
Gibson	97,822	14,891	3,813	116,526	90,150	.77	232	197
Greene	913,895	12,089	18,637	944,621	873,447	.92	226	1,550
Knox	57,684	30,645	6,250	94,579	99,890	1.06	145	170
Parke	586,919	12,497	31,616	631,032	696,053	1.10	198	1,403
Perry	15,522	1,000	300	16,822	21,027	1.25	106	60
Pike	258,434	3,734	7,100	269,268	251,815	.94	167	577
Spencer	1,600	17,285	....	18,885	23,299	1.23	170	31
Sullivan	868,328	20,607	21,790	910,725	820,664	.90	210	1,451
Vanderburg	72,701	109,775	11,240	193,716	218,109	1.13	206	363
Vermilion	669,882	2,472	11,899	684,253	590,265	.86	151	1,019
Vigo	1,301,463	22,682	37,896	1,362,041	1,244,794	.91	202	2,100
Warrick	238,076	34,507	13,485	286,068	296,599	1.04	214	369
Small mines	....	36,000	....	36,000	36,000	......	....	....
Total	6,373,083	353,111	192,031	6,918,225	7,017,143	1.01	194	12,968

The distribution of the total product for the years 1889 to 1901 is shown in the following table:

Distribution of the coal product of Indiana from 1889 to 1901, inclusive.

Year.	Loaded at mines for shipment.	Sold to local trade and used by employees.	Used at mines for steam and heat.	Made into coke.	Total product.	Total value.	Average price per ton.	Average number of days active.	Average number of employees.
	Short tons.	*Short tons.*	*Short tons.*	*Short tons.*	*Short tons.*				
1889	2,527,112	237,935	67,210	12,800	2,845,057	$2,887,852	$1.02	....	6,448
1890	3,036,737	225,167	34,703	9,130	3,305,737	3,259,233	.91	220	5,489
1891	2,689,780	211,854	63,152	8,688	2,973,474	3,070,918	1.03	190	5,879
1892	3,088,911	208,220	42,621	5,422	3,345,174	3,620,582	1.08	225	6,436
1893	3,461,830	252,879	69,797	7,345	3,791,851	4,055,372	1.07	201	7,644
1894	3,085,664	248,398	67,545	22,314	3,423,921	3,295,034	.96	149	8,603
1895	3,488,876	392,423	104,695	9,898	3,995,892	3,642,623	.91	189	8,530
1896	3,471,470	311,911	113,442	8,956	3,905,779	3,261,737	.84	163	8,806
1897	3,639,758	393,012	111,376	7,023	4,151,169	3,472,348	.84	176	8,886
1898	4,398,078	387,790	130,810	4,065	4,920,743	3,994,918	.81	199	8,971
1899	5,465,609	376,574	160,621	3,719	6,006,523	5,285,018	.88	218	9,712
1900	5,947,462	372,948	161,071	2,605	6,484,086	6,687,137	1.03	199	11,720
1901	6,373,083	353,111	192,031	....	6,918,225	7,017,143	1.01	194	12,968

The production, by counties, during the last six years is presented in the following table, with the increase or decrease in each county in 1901:

Coal production of Indiana since 1895, by counties.

County.	1896.	1897.	1898.	1899.	1900.	1901.	Increase, 1901.	Decrease, 1901.
	Short tons.	*Short tons.*	*Short tons.*	*Short tons.*	*Short tons.*	*Short tons.*	*Short tons.*	*Short tons.*
Clay	1,232,435	925,727	928,607	1,253,948	1,165,302	1,080,164		85,138
Daviess	192,775	211,797	202,693	[a]266,029	[a]276,625	[a]238,699		37,926
Fountain	105,650	137,250	139,200	55,750	44,232	34,826		9,406
Gibson	24,775	41,409	63,006	75,420	66,889	116,526	49,637	
Greene	290,046	448,873	526,800	681,799	723,255	944,621	221,366	
Knox	30,500	36,752	56,532	49,684	60,749	94,579	33,830	
Owen			7,808					
Parke	339,677	434,007	551,137	638,181	649,665	631,032		18,633
Perry	26,227	23,712	27,162	28,700	24,077	16,822		7,255
Pike	201,417	248,043	248,478	191,589	245,433	269,268	23,835	
Spencer	16,703	4,339	6,633	13,946	9,106	18,885	9,779	
Sullivan	515,285	480,045	637,849	752,734	939,989	910,725		29,264
Vanderburg	170,755	182,800	197,072	152,430	192,532	193,716	1,184	
Vermilion	347,166	321,560	261,738	609,876	649,525	684,253	34,728	
Vigo	237,647	442,531	884,109	1,029,699	1,151,643	1,362,041	210,398	
Warrick	138,721	176,324	145,919	170,738	249,064	286,068	37,004	
Small mines	36,000	36,000	36,000	36,000	36,000	36,000		
Total	3,905,779	4,151,169	4,920,743	6,006,523	6,484,086	6,918,225	[b]434,139	

[a] Includes Martin County.

[b] Net increase.

The total production of the State since 1873 has been as follows:

Production of coal in Indiana from 1873 to 1901, inclusive.

[Short tons.]

Year.	Quantity.	Year.	Quantity.
1873	1,000,000	1888	3,140,979
1874	812,000	1889	2,845,057
1875	800,000	1890	3,305,737
1876	950,000	1891	2,973,474
1877	1,000,000	1892	3,345,174
1878	1,000,000	1893	3,791,851
1879	1,196,490	1894	3,423,921
1880	1,500,000	1895	3,995,892
1881	1,771,536	1896	3,905,779
1882	1,976,470	1897	4,151,169
1883	2,560,000	1898	4,920,743
1884	2,260,000	1899	6,006,523
1885	2,375,000	1900	6,484,086
1886	3,000,000	1901	6,918,225
1887	3,217,711		

INDIAN TERRITORY.

Total production in 1901 2,421,781 short tons; spot value, $3,915,268.

The production of coal in Indian Territory in 1901 exceeded a total of 2,000,000 tons for the first time in the history of the Territory. As compared with 1900 the output in 1901 shows an increase of 499,483 short tons, or 26 per cent.

The fact that the coal production of the Indian Territory made so large an increase in 1901, in spite of the fact that a large amount of the Territory coal was displaced in the markets of southern Texas by the consumption of fuel oil, speaks eloquently of the industrial development of the regions tributary to this important coal-producing section. The Territory coal compares highly, particularly as a steam-raising fuel, with any coals of the Mississippi Valley and Western States. The development has been almost without interruption and, at times, rapid since the first year in which any product was reported, which was for 1885. The output last year was almost exactly double that of 1895, while the average price realized was the highest obtained since 1893. There have been few years in which the coal-mining industry of the Indian Territory has been in a more prosperous condition than it was in 1901.

In the following table are shown the details of production in Indian Territory during the last eleven years:

Distribution of the coal product of the Indian Territory since 1891.

Year.	Loaded at mines for shipment.	Sold to local trade and used by employees.	Used at mines for steam and heat.	Made into coke.	Total product.	Total value.	Average price per ton.	Average number of days active.	Average number of employees
	Short tons.	*Short tons.*	*Short tons.*	*Short tons.*	*Short tons.*				
1891..........	1,026,932	9,405	22,163	32,532	1,091,032	$1,897,037	$1.74	222	2,891
1892..........	1,156,603	10,840	18,089	7,189	1,192,721	2,043,479	1.71	211	3,257
1893..........	1,197,468	9,234	21,663	23,745	1,252,110	2,235,209	1.79	171	3,446
1894..........	923,581	4,632	30,878	10,515	969,606	1,541,293	1.59	157	3,101
1895..........	1,173,399	3,070	21,935	12,781	1,211,185	1,737,254	1.43	164	3,212
1896..........	1,295,742	12,648	45,560	12,696	1,366,646	1,918,115	1.40	170	3,549
1897..........	1,250,066	9,068	47,501	29,745	1,336,380	1,787,358	1.34	176	3,168
1898..........	1,310,178	16,632	34,055	20,601	1,381,466	1,827,638	1.32	198	3,216
1899..........	1,444,063	12,280	54,222	26,862	1,537,427	2,199,785	1.43	212	4,084
1900..........	1,796,422	14,786	54,137	56,953	1,922,298	2,788,124	1.45	228	4,525
1901..........	2,249,100	31,370	83,183	58,128	2,421,781	3,915,268	1.62	208	6,706

Since 1885 the annual production has been as follows:

Production of coal in the Indian Territory from 1885 to 1901, inclusive.

Year.	Quantity.	Value.	Average price per ton.	Average number of days active.	Average number of employees.
	Short tons.				
1885	500,000	....	....	....	....
1886	534,580	$855,328	$1.60	....	....
1887	685,911	1,286,692	1.88	....	....
1888	761,986	1,432,072	1.89	....	....
1889	752,832	1,323,807	1.76	....	1,862
1890	869,229	1,579,188	1.82	238	2,571
1891	1,091,032	1,897,037	1.71	222	2,891
1892	1,192,721	2,043,479	1.71	211	3,257
1893	1,252,110	2,235,209	1.79	171	3,446
1894	969,606	1,541,293	1.59	157	3,101
1895	1,211,185	1,737,254	1.43	164	3,212
1896	1,366,646	1,918,115	1.40	170	3,549
1897	1,336,380	1,787,358	1.34	176	3,168
1898	1,381,466	1,827,638	1.32	198	3,216
1899	1,537,427	2,199,785	1.43	212	4,084
1900	1,922,298	2,788,224	1.45	228	4,525
1901	2,421,781	3,915,268	1.62	208	6,706

IOWA.

Total production in 1901, 5,617,499 short tons; spot value, $7,822,605.

Iowa is one of the States whose coal output in 1901 was the largest in its history. In addition to this, the average price was the highest obtained since 1886, although it was only 1 cent more per ton than that for the preceding year. As compared with 1900 the production of the State last year increased 414,560 short tons, or 7.9 per cent. The value increased $667,464, or 9.3 per cent.

There are 24 counties in the State in which coal was produced in commercial quantities in 1901 and 1900. In 18 of these the output in 1901 was larger than that of the preceding year. The most important increases were in Monroe and Polk counties. The largest decrease was in Mahaska County, which fell off nearly 213,000 tons, and dropped from first to third place in rank, first place being taken by Monroe County and second place by Polk.

The statistics of production by counties during the last two years, with distribution of the product for consumption, are shown in the following tables:

Coal production of Iowa in 1900, by counties.

County.	Loaded at mines for shipment.	Sold to local trade and used by employees.	Used at mines for steam and heat.	Total production.	Total value.	Average price per ton.	Average number of days active.	Average number of employees.
	Short tons.	*Short tons.*	*Short tons.*	*Short tons.*				
Adams	....	21,950	....	21,950	$41,764	$1.90	160	110
Appanoose	654,675	18,396	7,023	680,094	1,029,489	1.51	180	2,419
Boone	237,692	23,596	5,254	266,542	451,056	1.69	218	791
Dallas	8,773	7,692	272	16,737	30,531	1.82	171	76
Davis and Lee	....	1,398	....	1,398	2,395	1.71	130	12
Greene	3,500	13,344	200	17,044	31,699	1.86	188	70
Jasper	87,024	10,925	1,999	99,948	135,462	1.35	242	217
Jefferson	2,250	1,325	75	3,650	6,062	1.66	185	14
Keokuk	232,538	17,561	8,834	258,933	353,145	1.36	261	426
Lucas	211,461	7,720	8,740	227,921	300,840	1.32	246	388
Mahaska	1,091,117	24,049	26,851	1,142,017	1,408,655	1.23	251	2,045
Marion	158,637	23,371	4,438	186,446	234,009	1.26	217	417
Monroe	710,989	14,757	29,540	755,286	859,720	1.14	254	1,592
Page and Story	3,500	4,994	....	8,494	22,725	2.68	154	28
Polk	570,386	241,915	15,181	827,482	1,250,430	1.51	242	1,661
Scott	12,700	16,946	200	29,846	49,174	1.65	177	93
Taylor	15,270	1,879	10	17,159	34,318	2.00	250	48
Van Buren	8,676	3,352	80	12,108	17,880	1.48	242	24
Wapello	235,112	36,593	4,655	276,360	359,616	1.30	255	564
Warren	7,000	17,690	34	24,724	34,695	1.40	197	69
Wayne	34,537	30,265	338	65,140	96,584	1.48	179	218
Webster	103,507	16,754	3,399	123,660	230,092	1.86	218	326
Small mines	....	140,000	....	140,000	175,000	....	....	....
Total	4,389,344	696,472	117,123	5,202,939	7,155,341	1.38	228	11,608

Coal production of Iowa in 1901, by counties.

County.	Loaded at mines for shipment.	Sold to local trade and used by employees.	Used at mines for steam and heat.	Total production.	Total value.	Average price per ton.	Average number of days active.	Average number of employees.
	Short tons.	*Short tons.*	*Short tons.*	*Short tons.*				
Adams	4,000	14,035	56	18,091	$36,395	$2.01	166	84
Appanoose	698,291	17,904	5,802	721,997	1,121,265	1.55	167	2,533
Boone	235,020	17,607	1,427	254,054	423,827	1.67	212	809
Dallas	5,220	10,622	1,145	16,987	31,072	1.83	202	56
Davis	....	1,986	....	1,986	3,913	1.97	82	18
Greene	6,700	11,381	729	18,810	31,652	1.68	169	59
Jasper	173,029	8,821	2,820	184,670	270,369	1.46	236	382
Jefferson	1,500	2,375	....	3,875	7,568	1.95	126	17
Keokuk	268,032	18,755	21,406	308,193	425,876	1.38	231	585
Lucas	207,721	4,675	8,662	221,058	274,416	1.24	208	432
Mahaska	874,019	34,299	20,792	929,110	1,161,242	1.25	228	1,601
Marion	117,167	23,243	5,571	145,981	173,882	1.19	196	257
Monroe	1,003,339	14,448	20,545	1,038,332	1,292,503	1.24	265	2,319
Page and Story	....	6,740	....	6,740	16,850	2.50	285	17
Polk	732,412	250,353	42,249	1,025,014	1,492,060	1.46	221	2,165
Scott	1,320	15,631	146	17,097	27,378	1.60	161	82
Taylor	19,409	4,075	15	23,499	49,570	2.11	242	80
Van Buren	9,272	3,290	10	12,572	18,997	1.51	189	27
Wapello	282,250	24,974	4,950	312,174	407,136	1.30	234	609
Warren	3,120	11,541	....	14,661	27,847	1.90	133	63
Wayne	44,140	11,541	897	56,578	88,486	1.56	192	130
Webster	124,992	18,586	2,442	146,020	265,501	1.82	243	328
Small mines	....	140,000	....	140,000	175,000	......	....	....
Total	4,810,953	666,882	139,664	5,617,499	7,822,805	1.39	218	12,653

The distribution of the product during the last thirteen years has been as follows:

Distribution of the coal product of Iowa from 1889 to 1901, inclusive.

Year.	Loaded at mines for shipment.	Sold to local trade and used by employees.	Used at mines for steam and heat.	Made into coke.	Total product.	Total value.	Average price per ton.	Average number of days active.	Average number of employees.
	Short tons.	*Short tons.*	*Short tons.*	*Short tons.*	*Short tons.*				
1889	3,530,373	464,735	100,213	37	4,095,358	$5,426,509	$1.33	....	9,247
1890	3,560,738	397,503	63,498	....	4,021,739	4,995,739	1.24	213	8,130
1891	3,263,347	373,025	88,966	157	3,725,495	4,867,999	1.27	224	8,124
1892	3,459,025	401,855	57,611	....	3,918,491	5,175,060	1.32	236	8,170
1893	3,442,584	449,639	80,006	....	3,972,229	5,110,460	1.30	204	8,863
1894	3,390,751	511,683	64,819	....	3,967,253	4,997,939	1.26	170	9,995
1895	3,630,867	460,820	64,387	....	4,156,074	4,982,102	1.20	189	10,066
1896	3,367,819	494,443	91,766	....	3,954,028	4,628,022	1.17	178	9,672
1897	4,023,944	516,427	71,494	....	4,611,865	5,219,503	1.13	201	10,703
1898	3,981,362	572,063	65,417	....	4,618,842	5,260,716	1.14	219	10,262
1899	4,479,743	622,401	75,335	....	5,177,479	6,397,338	1.24	229	10,971
1900	4,389,344	696,472	117,123	....	5,202,939	7,155,341	1.38	228	11,608
1901	4,810,953	666,882	139,664	....	5,617,499	7,822,805	1.39	218	12,653

In the following table is shown the production by counties for the last six years, with the increases and decreases in 1901 as compared with the preceding year:

Coal production of Iowa since 1896, by counties.

[Short tons.]

County.	1896.	1897.	1898.	1899.	1900.	1901.	Increase, 1901.	Decrease, 1901.
Appanoose	544,678	670,143	608,165	636,421	680,094	721,997	41,903	....
Boone	316,756	292,218	331,543	290,525	266,542	254,054	....	12,488
Dallas	9,624	6,853	7,907	10,804	16,737	16,987	250	....
Greene		9,245	12,920	17,568	17,044	18,810	1,766	....
Jasper	164,110	175,316	143,935	191,928	99,948	184,670	84,722	....
Keokuk	214,474	289,478	251,145	314,900	258,933	308,193	49,260	....
Lucas	....	....	6,600	32,419	227,921	221,058	....	6,863
Mahaska	1,047,241	1,420,510	1,292,787	1,273,473	1,142,017	929,110	....	212,907
Marion	93,023	129,502	127,293	231,668	186,446	145,981	....	40,465
Monroe	433,520	497,831	584,578	689,004	755,286	1,038,332	283,046	....
Polk	546,051	489,136	635,606	749,708	827,482	1,025,014	197,532	....
Taylor	8,400	10,726	6,555	10,965	17,159	23,499	6,340	....
Van Buren	8,396	5,760	6,600	9,385	12,108	12,572	464	....
Wapello	227,077	229,470	249,624	325,029	276,360	312,174	35,814	....
Warren	12,824	6,610	7,120	34,815	24,724	14,661	....	10,063
Wayne	42,732	56,996	51,550	62,818	65,140	56,578	....	8,562
Webster	134,704	168,899	137,548	124,841	123,660	146,020	22,360	....
Other counties and small mines	150,418	153,172	157,366	171,208	205,338	187,789	....	17,549
Total	3,954,028	4,611,865	4,618,842	5,177,479	5,202,939	5,617,499	[a] 414,560	....

[a] Net increase.

The first year for which any production was reported in Iowa was 1860, and the production amounted to 48,263 short tons. From this time it increased rapidly each year until 1883, when it reached a total of 4,457,544 short tons. The industry then came practically to a standstill, without any material increases or decreases in any one year for fifteen years. In 1899, an increase of nearly 560,000 tons was reported, with another small increase in 1900. The further increase of over 400,000 tons in 1901 brought the production for last year up to about 1,000,000 tons more than that of 1898. These conditions are exhibited in the following table, which shows the production since 1860.

Production of coal in Iowa from 1860 to 1901, inclusive.

Year.	Quantity.	Value.	Average price per ton.	Year.	Quantity.	Value.	Average price per ton.
	Short tons.				*Short tons.*		
1860	48,263	$92,180	$1.91	1889	4,095,358	5,426,509	$1.33
1865	69,574	....	....	1890	4,021,739	4,995,739	1.24
1866	99,320	....	....	1891	3,825,495	4,807,999	1.27
1868	241,453	....	....	1892	3,918,491	5 175,060	1.32
1870	283,467	....	....	1893	3,972,229	5,110,460	1.30
1875	1,231,547	2,500,140	2.03	1894	3,967,253	4,997,939	1.26
1880	1,461,166	2,507,453	1.72	1895	4,156,074	4,982,102	1.20
1882	3,920,000	....	....	1896	3,954,028	4,628,022	1.17
1883	4,457,540	....	....	1897	4,611,865	5,219,503	1.13
1884	4,370,566	....	....	1898	4,618,842	5,260,716	1.14
1885	4,012,575	....	....	1899	5,177,479	6,397,338	1.24
1886	4,315,779	5,391,151	1.25	1900	5,202,939	7,155,341	1.38
1887	4,473,828	5,991,735	1.34	1901	5,617,499	7,822,605	1.39
1888	4,952,440	6,438,172	1.30				

KANSAS.

Total production in 1901, 4,900,528 short tons; spot value, $5,991,599.

The year 1901 was the fourth consecutive year in which the coal production of Kansas exceeded that of all previous records. In 1900 the output exceeded for the first time a total of 4,000,000 tons, and in 1901 the product further increased by 432,658 short tons, or 9.7 per cent over 1900. The production has increased steadily each year since 1896, compared with which year 1901 shows an increase of practically 2,000,000 tons. The value of the product in 1901 exceeded that of the preceding year by $536,908 and that of 1896 by nearly $2,700,000. The average price per ton in 1901 was the same as that of the preceding year.

The State ranks third among the coal-producing States west of the the Mississippi River, Colorado being first and Iowa second. Shortly after the close of 1901 an important deal was made which will probably affect the coal-mining industry of the State for the future. This consisted in the transfer of the properties previously controlled by the Kansas and Texas Coal Company, of St. Louis, to the Central Coal and Coke Company, formerly the Keith and Perry Coal Company, of Kansas City. This deal is said to have been made in the interests of the Missouri Pacific System, which is reported to have friendly connections with the Central Coal and Coke Company.

The details of production in 1900 and 1901, by counties, with the distribution of the product for consumption, are shown in the following tables:

Coal production of Kansas in 1900, by counties.

County.	Loaded at mines for shipment.	Sold to local trade and used by employees.	Used at mines for steam and heat.	Total production.	Total value.	Average price per ton.	Average number of days active.	Average number of employees
	Short tons.	*Short tons.*	*Short tons.*	*Short tons.*				
Cherokee	1,509,846	19,665	17,960	1,547,471	$1,716,051	$1.11	229	2,968
Cloud	....	6,035	....	6,035	15,117	2.50	149	33
Crawford	2,241,127	41,790	24,213	2,307,130	2,704,781	1.17	251	3,657
Franklin	1,731	2,420	269	4,420	10,090	2.28	160	25
Leavenworth	179,290	60,822	10,117	250,229	456,437	1.82	200	822
Linn	24,060	2,380	200	26,640	36,240	1.36	180	92
Osage	172,838	24,021	139	196,998	371,117	1.88	198	809
Atchison, Coffey, and and Lyon	....	5,984	....	5,984	17,952	3.00	260	26
Ellsworth, Labette, and Lincoln	....	2,963	....	2,963	6,906	2.33	115	27
Small mines	....	120,000	....	120,000	120,000	......	....	....
Total	4,128,892	286,080	52,898	4,467,870	5,454,691	1.22	232	8,459

Coal production of Kansas in 1901, by counties.

County.	Loaded at mines for shipment.	Sold to local trade and used by employees.	Used at mines for steam and heat.	Total production.	Total value.	Average price per ton.	Average number of days active.	Average number of employees.
	Short tons.	*Short tons.*	*Short tons.*	*Short tons.*				
Cherokee	1,504,162	23,063	22,973	1,550,198	$1,772,252	$1.14	214	2,821
Cloud	....	7,870	....	7,870	19,575	2.49	123	43
Crawford	2,640,850	27,570	40,281	2,708,701	3,124,164	1.15	239	5,038
Franklin	2,182	9,278	....	11,460	21,838	1.90	219	56
Leavenworth	180,372	59,230	8,874	248,476	460,008	1.85	208	983
Linn	24,000	2,080	300	26,380	34,650	1.31	228	63
Osage	188,424	33,668	201	222,293	429,562	1.93	190	893
Atchison, Coffey, and Lyon	....	4,600	....	4,600	7,900	1.72	268	21
Ellsworth, Labette, and Lincoln	....	550	....	550	1,650	3.00	142	10
Small mines	....	120,000	....	120,000	120,000	......	....	....
Total	4,539,990	287,909	72,629	4,900,528	5,991,599	1.22	224	9,928

The distribution of the product for consumption, the total value, and the statistics of labor employed for the last thirteen years have been as follows:

Distribution of the coal product of Kansas from 1889 to 1901, inclusive.

Year.	Loaded at mines for shipment.	Sold to local trade and used by employees.	Used at mines for steam and heat.	Made into coke.	Total product.	Total value.	Average price per ton.	Average number of days active.	Average number of employees.
	Short tons.	*Short tons.*	*Short tons.*	*Short tons.*	*Short tons.*				
1889	1,891,090	300,207	29,246	500	2,221,043	$3,296,888	$1.48	....	5,956
1890	2,028,100	224,839	6,983	....	2,259,922	2,947,517	1.30	210	4,523
1891	2,428,787	255,839	31,946	133	2,716,705	3,557,305	1.31	222	6,201
1892	2,756,812	206,038	44,325	101	3,007,276	3,955,595	1.32	208	6,559
1893	2,364,810	227,321	60,412	3	2,652,546	3,375,740	1.27	147	7,310
1894	3,066,398	275,565	45,523	765	3,388,251	4,178,998	1.23	164	7,339
1895	2,587,602	279,739	59,142	387	2,926,870	3,481,981	1.20	159	7,482
1896	2,562,779	256,906	63,901	1,215	2,884,801	3,295,032	1.15	168	7,127
1897	2,745,101	253,933	54,730	248	3,054,012	3,602,326	1.18	194	6,639
1898	3,079,601	277,022	49,932	....	3,406,555	3,703,014	1.09	194	7,197
1899	3,524,497	276,918	50,852	....	3,852,267	4,478,112	1.16	226	8,000
1900	4,128,892	286,080	52,898	....	4,467,870	5,454,691	1.22	232	8,459
1901	4,539,990	287,909	72,629	....	4,900,528	5,991,599	1.22	224	9,928

The following table shows the production during the last six years, distributed by counties, with the increases and decreases in 1901 as compared with 1900. The principal gain in production last year was made by Crawford County, which contributed nearly 55 per cent of the total output of the State. The second county in importance is Cherokee, with about 30 per cent of the total. These two counties have yielded over 80 per cent of the total for several years.

Coal production of Kansas since 1897, by counties.

[Short tons.]

County.	1897.	1898.	1899.	1900.	1901.	Increase, 1901.	Decrease, 1901.
Atchison	7,250	3,000	3,000	2,000	3,000	1,000	....
Cherokee	1,004,921	1,110,527	1,162,142	1,547,471	1,550,198	2,727	....
Crawford	1,352,923	1,654,493	1,951,504	2,307,130	2,708,701	401,571	....
Franklin	5,140	6,433	14,050	4,420	11,460	7,040	....
Leavenworth	366,362	305,576	312,845	250,229	248,476	....	1,753
Linn	27,432	20,542	17,260	26,640	26,380	....	260
Osage	169,395	182,156	262,331	196,998	222,293	25,295	....
Other counties and small mines	120,589	123,828	129,135	132,982	130,020	....	2,962
Total	3,054,012	3,406,555	3,852,267	4,467,870	4,900,528	[a] 432,658	....

[a] Net increase.

The first production of coal in Kansas of which there is any record was in 1880, in which year the production amounted to 550,000 short tons. Since that time the production has increased with almost uniform regularity, there being only three years in twenty-two in which a decrease was shown. These decreases were recorded in the panic years of 1893, 1895, and 1896.

Coal production of Kansas since 1880.

Year.	Quantity.	Value.	Average price per ton.	Year.	Quantity.	Value.	Average price per ton.
	Short tons.				*Short tons.*		
1880	550,000			1891	2,716,705	$3,557,305	$1.31
1881	750,000			1892	3,007,276	3,955,595	1.32
1882	750,000			1893	2,652,546	3,375,740	1.27
1883	900,000			1894	3,388,351	4,178,998	1.23
1884	1,100,000			1895	2,926,870	3,481,981	1.20
1885	1,212,057	$1,485,002	$1.23	1896	2,884,801	3,295,032	1.15
1886	1,400,000	1,680,000	1.20	1897	3,054,012	3,602,326	1.18
1887	1,596,879	2,235,631	1.40	1898	3,406,555	3,703,014	1.09
1888	1,850,000	2,775,000	1.50	1899	3,852,267	4,478,112	1.16
1889	2,221,043	3,296,888	1.48	1900	4,467,870	5,454,691	1.22
1890	2,259,922	2,947,517	1.30	1901	4,900,528	5,991,599	1.22

KENTUCKY.

Total production in 1901, 5,469,986 short tons; spot value, $5,213,076.

In the report for 1900 mention was made of the great strides made by Kentucky in 1899 and 1900. Prior to 1899 the output had not exceeded a total of 4,000,000 tons in any one year, and in 1898 it had fallen off to 3,887,908 short tons. In 1899 the production suddenly increased to 4,607,255 short tons, a gain of over 1,700,000 tons. A further increase of 721,709 short tons was recorded in 1900, and it was followed in 1901 by a gain of 141,022 tons, making a total gain in the last three years of over 2,580,000 tons, or nearly 70 per cent. In addition to this, the value of the product has increased in greater proportion than the output, the average price having advanced from 79 cents in 1897, 1898, and 1899 to 92 cents in 1900 and 95 cents in 1901.

The details of production during 1900 and 1901 are shown in the following tables:

Coal production of Kentucky in 1900, by counties.

County.	Loaded at mines for shipment.	Sold to local trade and used by employees.	Used at mines for steam and heat.	Made into coke.	Total production.	Total value.	Average price per ton.	Average number of days active.	Average number of employees.
	Short tons.	*Short tons.*	*Short tons.*	*Short tons.*	*Short tons.*				
Bell	127,394	7,780	4,700	84,626	224,500	$223,804	$1.00	165	680
Boyd	164,858	1,877	4,196	....	170,931	119,995	.70	247	312
Butler	24,159	8,313	10	....	32,482	32,208	.99	158	120
Carter	247,079	637	1,040	....	248,756	247,741	1.00	249	532
Henderson	112,679	21,676	1,420	....	135,775	121,344	.89	173	250
Hopkins	1,243,347	24,442	26,264	77,773	1,371,826	1,078,757	.79	277	1,771
Johnson	18,548	616	....	....	19,164	30,239	1.58	268	98
Knox	294,587	4,600	4,782	....	303,969	279,445	.92	256	456
Laurel	344,349	2,497	4,940	....	351,786	334,677	.95	210	860
Lawrence	39,705	663	5,948	....	46,316	39,317	.85	263	107
McLean	19,719	485	250	....	20,454	15,650	.77	97	56
Muhlenburg	386,510	5,559	7,875	....	399,944	327,688	.82	202	839
Ohio	536,348	6,124	10,193	....	552,665	463,226	.84	215	881
Pulaski	90,381	1,235	1,344	....	92,960	105,243	1.13	152	336
Rockcastle	8,000	....	....	....	8,000	10,000	1.25	162	25
Union	230,411	23,099	9,761	4,862	268,133	279,720	1.04	261	507
Webster	100,038	6,917	3,610	....	110,565	87,105	.79	222	128
Whitley	649,969	18,660	4,440	....	673,069	773,538	1.15	230	1,464
Breathitt and Lee	32,258	358	800	....	33,416	41,166	1.23	192	80
Christian, Daviess, and Hancock	112,723	980	550	....	114,253	83,214	.73	220	178
Small mines	....	150,000	....	....	150,000	187,500	....	....	....
Total	4,783,062	286,518	92,123	167,261	5,328,964	4,881,577	.92	227	9,680

Coal production of Kentucky in 1901, by counties.

County.	Loaded at mines for shipment.	Sold to local trade and used by employees.	Used at mines for steam and heat.	Made into coke.	Total production.	Total value.	Average price per ton.	Average number of days active.	Average number of employees.
	Short tons.	*Short tons.*	*Short tons.*	*Short tons.*	*Short tons.*				
Bell	257,765	5,420	3,850	66,200	333,235	$336,874	$1.01	205	1,113
Boyd	172,030	680	1,220	....	173,930	138,902	.80	282	381
Butler	14,960	3,842	....	....	18,802	16,851	.90	95	80
Carter	234,335	8,072	3,119	....	245,526	314,020	1.28	239	468
Henderson	139,849	27,133	2,383	....	169,365	156,314	.92	212	332
Hopkins	1,216,132	24,093	31,435	90,639	1,362,299	1,069,258	.78	254	1,818
Johnson and Morgan	36,782	710	200	....	37,692	57,897	1.54	201	232
Knox	277,003	2,260	4,443	....	283,706	282,520	1.00	226	487
Laurel	310,986	2,296	2,416	....	315,698	282,642	.90	198	781
Lawrence	36,449	2,615	7,860	....	46,924	48,861	1.04	236	95
McLean	17,226	340	150	....	17,716	13,993	.79	79	77
Muhlenberg	520,067	6,277	6,192	304	532,840	472,866	.89	176	957
Ohio	493,787	5,347	3,840	....	502,974	445,622	.89	197	801
Pulaski	128,348	7,710	2,729	....	138,787	168,764	1.22	222	326
Rockcastle	12,000	3,000	....	....	15,000	15,000	1.00	250	30
Union	251,283	14,045	7,875	4,134	277,337	251,629	.91	195	470
Webster	113,261	3,092	5,763	....	122,116	103,824	.85	220	234
Whitley	581,622	5,494	3,952	....	591,068	725,515	1.23	195	1,352
Breathitt and Lee	37,126	200	....	....	37,326	44,682	1.20	206	92
Christian, Daviess, and Hancock	96,705	420	520	....	97,645	79,542	.81	236	181
Small mines	....	150,000	....	....	150,000	187,500	....	....	....
Total	4,947,716	273,046	87,947	161,277	5,469,986	5,213,076	.95	213	10,307

The distribution of the product for consumption since 1889 is shown in the following table:

Distribution of the coal product of Kentucky from 1889 to 1901, inclusive.

Year.	Loaded at mines for shipment.	Sold to local trade and used by employees.	Used at mines for steam and heat.	Made into coke.	Total product.	Total value.	Average price per ton.	Average number of days active.	Average number of employees.
	Short tons.	*Short tons.*	*Short tons.*	*Short tons.*	*Short tons.*				
1889	2,111,010	246,306	23,981	18,458	2,399,755	$2,374,339	$0.98	....	....
1890	2,357,989	291,666	29,568	22,273	2,701,496	2,472,119	.92	219	5,259
1891	2,559,263	285,281	21,363	50,162	2,916,069	2,715,600	.93	225	6,355
1892	2,620,556	327,985	33,856	42,916	3,025,313	2,771,238	.92	217	6,724
1893	2,613,645	281,115	30,969	81,450	3,007,179	2,613,569	.86	202	6,581
1894	2,734,847	281,235	47,344	47,766	3,111,192	2,749,932	.88	145	8,083
1895	3,012,610	254,028	50,294	40,838	3,357,770	2,890,247	.86	153	7,799
1896	2 980,355	251,897	55,447	45,779	3,333,478	2,684,306	.78	165	7,549
1897	3,088,132	404,099	55,033	54,833	3,602,097	2,828,329	.79	178	7,983
1898	3,537,429	253,629	55,206	41,644	3,887,908	3,084,551	.79	187	7,614
1899	4,139,199	282,736	67,136	118,184	4,607,255	3,618,222	.79	224	7,461
1900	4,783,062	286,518	92,123	167,261	5,328,964	4,881,577	.92	227	9,680
1901	4,947,716	273,046	87,947	161,277	5,469,986	5,213,076	.95	213	10,307

The total production during the last five years, distributed by counties, with the increases and decreases in 1901 as compared with 1900 are shown in the following table:

Coal production of Kentucky since 1897, by counties.

[Short tons.]

County.	1897.	1898.	1899.	1900.	1901.	Increase, 1901.	Decrease, 1901.
Bell	103,261	85,544	152,934	224,500	333,235	108,735	....
Boyd	192,538	208,762	171,438	170,931	173,930	2,999	....
Breathitt and Lee	45,764	44,236	21,000	33,416	37,326	3,910	....
Butler	21,847	34,114	35,174	32,482	18,802	....	13,680
Carter	124,346	63,745	184,784	248,756	245,526	....	3,230
Christian, Daviess, and Hancock	33,902	93,087	12,484	114,253	97,645	....	16,608
Greenup	852	2,500	4,225	....	....	....	....
Henderson	107,187	86,395	136,628	135,775	169,365	33,590	....
Hopkins	976,412	974,959	1,204,683	1,371,826	1,362,299	....	9,527
Johnson	9,541	12,216	12,464	19,164	[a]37,692	18,528	....
Knox	158,445	281,575	235,682	303,969	283,706	....	20,263
Laurel	364,307	288,478	349,719	351,786	315,698	....	36,088
Lawrence	48,061	59,600	49,418	46,316	46,924	608	....
McLean	33,360	21,725	29,795	20,454	17,716	....	2,738
Muhlenberg	270,760	317,392	414,332	399,944	532,840	132,896	....
Ohio	466,295	440,011	505,913	552,665	502,974	....	49,691
Pulaski	47,847	86,770	103,469	92,960	138,787	45,827	....
Rockcastle	12,603	....	....	8,000	15,000	7,000	....
Union	126,896	193,665	185,405	268,133	277,337	9,204	....
Webster	65,982	55,850	122,391	110,565	122,116	11,551	....
Whitley	241,891	387,284	525,317	673,069	591,068	....	82,001
Small mines	150,000	150,000	150,000	150,000	150,000	....	....
Total	3,602,097	2,887,908	4,607,255	5,328,964	5,469,986	[b]141,022	....

[a] Includes Morgan County.

[b] Net increase.

Kentucky is the only one of the United States whose coal product is obtained from any two of the great coal fields. The coal-producing counties in the eastern portion of the State are included in the Coal Measures of the Appalachian system. The southern extremity of the Central coal field is found in the western counties of Kentucky. For a number of years the mines in the western portion of the State have contributed more than 50 per cent of the total production. In 1901 the western district produced 3,101,094 short tons, while the eastern counties produced 2,218,892 short tons. In 1900 the western district produced 3,006,097 short tons, as compared with 2,172,867 short tons in the eastern district. These figures are exclusive of the output of small country banks, of which there are from 1,500 to 2,000 in the State. The increases in production during 1901 were divided between the two districts in the proportion of about 2 to 1, the counties of the eastern district showing an increase of 46,025 short tons, while the western counties increased their production by 94,997 short tons.

The production from the two fields in Kentucky during the last five years has been as follows:

Coal production of the eastern district of Kentucky since 1897, exclusive of small mines.

[Short tons.]

County.	1897.	1898.	1899.	1900.	1901.	Increase, 1901.	Decrease, 1901.
Bell	103,261	85,544	152,934	224,500	333,235	108,735	....
Boyd	192,538	208,762	171,438	170,931	173,930	2,999	....
Breathitt	10,053	18,440	15,700	16,416	18,540	2,124	....
Carter	124,346	63,745	184,784	248,756	245,526	....	3,230
Greenup	852	2,500	4,225	....	....	....	....
Johnson	9,541	12,216	12,464	19,164	[a] 37,692	18,528	....
Knox	158,445	281,575	235,682	303,969	283,706	....	20,263
Laurel	364,307	288,478	349,719	351,786	315,698	....	36,088
Lawrence	48,061	59,600	49,418	46,316	46,924	608	....
Lee	35,711	25,796	5,300	17,000	18,786	1,786	....
Pulaski	47,847	86,770	103,469	92,960	138,787	45,827	....
Rockcastle	12,603	....	....	8,000	15,000	7,000	....
Whitley	241,891	387,284	525,317	673,069	591,068	....	82,001
Total	1,349,456	1,520,710	1,810,450	2,172,867	2,218,892	[b] 46,025	....

[a] Includes Morgan County.

[b] Net increase.

Coal production of the western district of Kentucky since 1897, exclusive of small mines.

[Short tons.]

County.	1897.	1898.	1899.	1900.	1901.	Increase, 1901.	Decrease, 1901.
Butler	21,847	34,114	35,174	32,482	18,802	....	13,680
Christian	13,000	66,496	....	93,931	73,220	....	20,711
Daviess	3,200	17,141	2,464	13,272	16,205	2,933	....
Hancock	17,702	9,450	10,020	7,050	8,220	1,170	....
Henderson	107,187	86,395	136,628	135,775	169,365	33,590	....
Hopkins	976,412	974,959	1,204,683	1,371,826	1,362,299	....	9,527
McLean	33,360	21,725	29,795	20,454	17,716	....	2,738
Muhlenberg	270,760	317,392	414,332	399,944	532,840	132,896	....
Ohio	466,295	440,011	505,913	552,665	502,974	....	49,691
Union	126,896	193,665	185,405	268,133	277,337	9,204	....
Webster	65,982	55,850	122,391	110,565	122,116	11,551	....
Total	2,102,641	2,217,198	2,646,805	3,006,097	3,101,094	[a] 94,997	....

[a] Net increase.

The first coal production in Kentucky was reported in 1873, with a total of 300,000 short tons. The development of the industry since that time has been as follows:

Annual coal production of Kentucky since 1873.

[Short tons.]

Year.	Quantity.	Year.	Quantity.
1873	300,000	1888	2,570,000
1874	360,000	1889	2,399,755
1875	500,000	1890	2,701,496
1876	650,000	1891	2,916,069
1877	850,000	1892	3,025,313
1878	900,000	1893	3,007,179
1879	1,000,000	1894	3,111,192
1880	1,000,000	1895	3,357,770
1881	1,100,000	1896	3,333,478
1882	1,300,000	1897	3,602,097
1883	1,650,000	1898	3,887,908
1884	1,550,000	1899	4,607,255
1885	1,600,000	1900	5,328,964
1886	1,550,000	1901	5,469,986
1887	1,933,185		

MARYLAND.

Total production in 1901, 5,113,127 short tons; spot value, $5,046,491.

The coal-mining industry of Maryland was seriously affected during 1900 by labor troubles, which caused a cessation of operations in some of the larger mines for from three to six months. Altogether, 4,787 men, out of a total of 5,319 men, were on strike at one time or another for an average of 105 days, entailing the total loss of 504,544 working days. As a result of this enforced idleness, the production decreased 782,708 tons, or over 16 per cent, as compared with 1899. During 1900 the average number of days worked by the 5,319 men employed was 203 days. In the preceding year the average time made was 275 days. In 1901 the industry was comparatively free from disturbances of any kind, and the production increased 1,088,439 tons, or 27 per cent, and reached the highest total in the history of the State. The decreased production in 1900, added to the extraordinary demand for coal which prevailed throughout the year, resulted in an advance in values from an average of 76 cents in 1899 to 98 cents in 1900, so that, while the output decreased nearly 800,000 tons, the total value increased over $260,000. The average price for 1901, notwithstanding the greatly increased production, remained steady at 99 cents, which is the highest figure recorded in fifteen years.

There are only two counties in the State in which coal is produced, Allegany and Garrett. More than 98 per cent of the product is from Allegany County.

Mining machines were introduced into the coal mines of Maryland for the first time in 1899, during which year 8 machines were employed and 16,545 short tons were won by them. In 1900 the number of machines in use had increased to 10, and the machine-mined product to 138,014 short tons. In 1901 there was a still further increase, namely, to 15 machines, and the amount of coal undercut by these machines was reported to be 177,724 short tons. All of the machines in use were of the pick or puncher pattern.

The statistics of coal production in Maryland are presented in the following tables:

Distribution of the coal product of Maryland since 1889.

Year.	Loaded at mines for shipment.	Sold to local trade and used by employees.	Used at mines for steam and heat.	Total product.	Total value.	Average price per ton.	Average number of days active.	Average number of employees.
	Short tons.	*Short tons.*	*Short tons.*	*Short tons.*				
1889	2,885,336	44,217	10,162	2,939,715	$2,517,474	$0.86	....	3,702
1890	3,296,393	52,621	8,799	3,357,813	2,899,572	.86	244	3,842
1891	3,771,584	36,959	11,696	3,820,239	3,082,515	.80	244	3,891
1892	3,385,384	30,955	3,623	3,419,962	3,063,580	.89	225	3,886
1893	3,676,137	26,833	13,071	3,716,041	3,267,317	.88	240	3,935
1894	3,435,600	51,750	14,078	3,501,428	2,687,270	.77	215	3,974
1895	3,840,991	59,950	14,644	3,915,585	3,160,592	.81	248	3,912
1896	4,068,558	53,046	22,332	4,143,936	3,299,928	.80	204	4,039
1897	4,391,703	27,762	22,663	4,442,128	3,363,996	.76	262	4,719
1898	4,618,990	36,941	18,953	4,674,884	3,532,257	.76	253	4,818
1899	4,716,581	68,750	22,065	4,807,396	3,667,056	.76	275	4,624
1900	3,949,539	51,565	23,584	4,024,688	3,927,381	.98	203	5,319
1901	5,043,991	41,282	27,854	5,113,127	5,046,491	.99	262	5,333

Production of coal in Maryland from 1883 to 1901, inclusive.

Year.	Quantity.	Value.	Average price per ton.	Average number of days active.	Average number of men employed.
	Short tons.				
1883	2,476,075	....	....	....	....
1884	2,765,617	....	....	....	....
1885	2,833,337	....	....	....	....
1886	2,517,577	$2,391,698	$0.95	....	....
1887	3,278,023	3,114,122	.95	....	....
1888	3,479,470	3,293,070	.95	....	....
1889	2,939,715	2,517,474	.86	....	3,702
1890	3,357,813	2,899,572	.86	244	2,842
1891	3,820,239	3,082,515	.80	244	3,891
1892	3,419,962	3,063,580	.89	225	3,886
1893	3,716,041	3,267,317	.88	240	3,935
1894	3,501,428	2,687,270	.77	215	3,974
1895	3,915,585	3,160,592	.81	248	3,912
1896	4,143,936	3,299,928	.80	204	4,039
1897	4,442,128	3,363,996	.76	262	4,719
1898	4,674,884	3,532,257	.76	253	4,818
1899	4,807,396	3,667,056	.76	275	4,624
1900	4,024,688	3,927,381	.98	203	5,319
1901	5,113,127	5,046,491	.98	262	5,333

Maryland and the adjoining counties in West Virginia, which make up what is known as the Cumberland region, are the only ones outside of the anthracite region of Pennsylvania where records of production have been kept from the earlier years. These have been commonly known as the Georges Creek or Cumberland and Piedmont regions. The Cumberland region was opened in 1842. The Piedmont region began shipping in 1853. The records of shipment have been carefully preserved and are published annually in the reports of the "Cumberland Coal Trade." The following table, which shows the shipments from this entire region, has been obtained from the published report of the "Cumberland Coal Trade."

Total shipments from the Cumberland coal field in

[Long tons.]

Year.	Frostburg region.						
	Cumberland and Pennsylvania R. R.				Cumberland Coal and Iron Company's railroad.		
	By Baltimore and Ohio R. R.	By Chesapeake and Ohio Canal.	By Pennsylvania R. R.	Total.	By Baltimore and Ohio R. R.	By Chesapeake and Ohio Canal.	Total.
1842	757	....	....	757	951	....	951
1843	3,661	....	....	3,661	6,421	....	6,421
1844	5,156	....	....	5,156	9,734	....	9,734
1845	13,738	....	....	13,738	10,915	....	10,915
1846	11,240	....	....	11,240	18,555	....	18,555
1847	20,615	....	....	20,615	32,325	....	32,325
1848	36,571	....	....	36,571	43 000	....	43,000
1849	63,676	....	....	63,676	78,773	....	78,773
1850	73,783	3,167	....	76,950	119,023	875	119,898
1851	70,893	51,438	....	122,331	103,808	31,540	135,348
1852	128,534	46,357	....	174,891	139,925	19,362	159,287
1853	150,381	84,060	....	234,441	155,278	70,535	225,813
1854	148,953	63,731	....	212,684	173,580	92,114	265,694
1855	93,691	77,095	....	170,786	97,710	100,691	198,401
1856	86,994	80,387	....	167,381	121,945	105,149	227,094
1857	80,743	55,174	....	135,917	88,573	54,000	142,573
1858	48,018	166,712	....	214,730	66,009	87,539	153,548
1859	48,415	211,639	....	260,054	72,423	86,203	158,626
1860	70,669	232,278	....	302,947	80,500	63,600	144,100
1861	23,878	68,303	....	92,181	25,983	29,296	55,279
1862	71,745	75,206	....	146,951	41,096	23,478	64,574
1863	117,796	173,269	....	291,065	111,087	43,523	154,610
1864	287,126	194,120	....	481,246	67,676	64,522	132,198
1865	384,297	285,295	....	669,592	104,651	57,907	162,558
1866	592,938	291,019	....	883,957	52,251	52,159	104,410
1867	623,031	385,249	....	1,008,280	40,106	72,904	113,010
1868	659,115	424,406	....	1,083,521	100,345	57,919	158,264
1869	1,016,777	573,243	....	1,590,020	130,017	78,908	208,925
					2,092,660	1,192,224	3,284,884
					Eckhart Branch R. R.		
1870	909,511	520,196	....	1,429,707	114,404	83,941	198,345
1871	1,247,279	656,085	....	1,903,364	69,864	194,254	264,118
1872	1,283,956	612,537	22,021	1,918,514	26,586	203,666	230,252
1873	1,509,570	641,220	114,589	2,265,379	89,765	137,582	227,347
1874	1,295,804	631,882	67,671	1,995,357	113,670	135,182	248,852
1875	1,095,880	715,673	160,213	1,971,766	52,505	164,165	216,670
1876	939,262	443,435	131,866	1,514,563	15,285	189,005	204,290
1877	755,278	473,946	170,884	1,399,808	63,181	111,350	174,531
1878	823,801	486,038	145,864	1,455,703	99,455	123,166	222,621
1879	933,240	397,009	154,264	1,484,513	141,907	104,238	246,145
1880	1,055,491	471,800	213,446	1,740,757	197,525	131,325	328,850
1881	1,113,263	270,156	153,501	1,536,920	271,570	151,526	423,096
1882	576,701	115,344	91,574	783,619	199,183	76,140	275,323
1883	851,985	302,678	217,065	1,371,728	197,235	141,390	338,625
1884	1,193,780	150,471	199,138	1,543,389	289,884	124,718	414,602
1885	1,091,904	171,460	206,227	1,469,591	289,407	117,829	407,236
1886	1,131,949	115,531	141,520	1,389,000	243,321	113,791	357,112
1887	1,584,114	132,177	176,241	1,892,532	332,798	125,305	458,103
1888	1,660,406	155,216	193,046	2,008,668	374,888	95,191	470,079
1889	1,430,381	26,886	177,152	1,634,419	368,497	26,407	394,904
1890	1.511,418	....	291,704	1,803,122	522,334	....	522,334
1891	1,628,574	9,070	289,232	1,926,876	463,142	39,294	502,436
1892	1,426,994	93,705	214,011	1,734,710	349,207	170,116	519,323
1893	1,332,634	135,409	360,807	1,828,850	341,321	201,947	543,268
1894	1,068,739	95,523	372,205	1,536,467	436,216	208,914	645,130
1895	1,193,834	101,076	255,133	1,550,043	464,407	212,534	676,941
1896	1,344,402	169,195	163,471	1,677,068	610,418	195,279	805,697
1897	1,790,813	96,536	169,679	2,057,028	586,592	166,691	753,283
1898	2,131,626	24,997	116,195	2,272,818	507,196	213,139	720,335
1899	2,334,109	27,570	161,191	2,522,870	473,608	164,853	638,461
1900	1,813,462	14,621	126,615	1,954,698	304,320	96,513	400,833
1901	2,683,109	193,063	373,195	3,249,367	(a)	(a)	(a)
Total	47,674,730	11,992,353	5,629,710	65,296,793	8,609,691	4,219,351	12,829,042

[a] Merged in Cumberland and Pennsylvania figures.

Maryland and West Virginia from 1842 to 1901, inclusive.

[Long tons.]

Frostburg region.				Piedmont region.		Total.			
Georges Creek and Cumberland R. R.				Georges Creek R. R.	Hampshire R. R. by Baltimore and Ohio R. R.	Baltimore and Ohio R. R., and local.	Chesapeake and Ohio Canal.	Pennsylvania R. R.	Aggregate.
By Chesapeake and Ohio Canal.	By Pennsylvania R. R.	Local, and Baltimore and Ohio R. R.	Total.						
......	......	......	......	......	......	1,708	......	......	1,708
......	......	......	......	......	......	10,082	......	......	10,082
......	......	......	......	......	......	14,890	......	......	14,890
......	......	......	......	......	......	24,653	......	......	24,653
......	......	......	......	......	......	29,795	......	......	29,795
......	......	......	......	......	......	52,940	......	......	52,940
......	......	......	......	......	......	79,571	......	......	79,571
......	......	......	......	......	......	142,449	......	......	142,449
......	......	......	......	......	......	192,806	4,042	......	196,848
......	......	......	......	......	......	174,701	82,978	......	257,679
......	......	......	......	......	......	268,459	65,719	......	334,178
......	......	......	......	73,725	......	376,219	157,760	......	533,979
......	......	......	......	181,303	......	503,836	155,845	......	659,681
......	......	......	......	227,245	65,570	478,486	183,786	......	662,272
......	......	......	......	269,210	42,765	502,330	204,120	......	706,450
......	......	......	......	252,368	51,628	465,912	116,574	......	582,486
......	......	......	......	218,318	63,060	395,405	254,251	......	649,656
......	......	......	......	257,740	47,934	426,512	297,842	......	724,354
......	......	......	......	289,298	52,564	493,031	295,878	......	788,909
......	......	......	......	85,554	36,660	172,075	97,599	......	269,674
......	......	......	......	69,482	36,627	218,950	98,684	......	317,634
......	......	......	......	266,430	36,240	531,553	216.792	......	748,345
......	......	......	......	......	44,552	399,354	258,642	......	657,996
......	......	......	......	......	71,345	560,293	343,202	......	903,495
......	......	......	......	......	90,964	736,153	343,178	......	1,079,331
......	......	......	......	......	72,532	735,669	458,153	......	1,193,822
......	......	......	......	......	88,658	848,118	482,325	......	1,330,443
......	......	......	......	......	83,724	1,230,518	652,151	......	1,882,669
				2,190,673					
				Empire and West Virginia mines.					
......	......	......	......	28,035	60,988	1,112,938	604,137	......	1,717,075
......	......	......	......	81,218	96,453	1,494,814	850,339	......	2,345,153
......	......	......	......	85,441	121,364	1,517,347	816,103	22,021	2,355,471
......	......	......	......	77,582	103,793	1,780,710	778,802	114,589	2,674,101
......	......	......	......	57,492	109,194	1,576,160	767,064	67,671	2,410,895
......	......	......	......	63,537	90,800	1,302,237	879,838	160,698	2,342.773
......	......	......	......	108,723	7,505	1,070,775	632,440	131,866	1,835,081
......	......	......	......	......	......	818,450	584,996	170,884	1,574,330
......	......	......	......	......	998	924,254	609,204	145,864	1,679,322
......	......	......	......	......	51	1,075,198	501,247	154,264	1,730,709
......	......	......	......	66,573	......	1,319,589	603,125	213,446	2,136,160
83,136	125,097	4,947	213,180	88,722	......	1,478,502	504,818	278,598	2,261,918
78,298	93,861	31,436	203,595	277,929	......	1,085,249	269,782	185,435	1,540,466
215,767	202,223	77,829	495,819	338,001	......	1,444,766	680,119	419.288	2,544,173
69,765	156,959	283,336	510,060	466,928	......	2,233,928	344,954	356,097	2,934,979
79,455	214,518	291,685	585,658	403,489	......	2,076,485	368,744	420,745	2,865,974
53,480	98,371	348,196	500,047	346,308	......	2,069,774	282,802	239,891	2,592,467
4,863	153,230	418,057	576,150	449,011	......	2,724,347	262,345	389,104	3,375,796
112	286,787	341,024	627,923	564,397	......	2,669,216	286,700	715,151	3,671,067
......	365,029	243,487	608,516	576,047	......	2,357,585	57,459	798,842	3,213,886
......	677,593	228,138	905,731	774,904	......	2,723,341	......	1,282,748	4,006,089
......	763,845	229,266	993,111	959,673	......	2,855,225	51,121	1,474,087	4,380,433
......	568,003	236,314	804,317	971,214	......	2,557,177	266,901	1,205,486	4,029,564
......	741,954	201,938	943,892	1,031,797	......	2,423,159	338,107	1,586,541	4,347,807
......	773,074	111,036	884,110	900,399	......	2,084,265	304,437	1,577,404	3,966,106
125	1,031,015	110,258	1,141,398	1,157,803	......	2,418,554	314,551	1,793,080	4,526,185
......	995,443	75,400	1,070,843	1,307,822	......	2,807,161	364,474	1,689,795	4,861,430
......	918,712	111,135	1,029,847	1,463,331	......	3,615,142	263,227	1,426,120	5,304,489
......	913,775	100,312	1,014,087	1,526,396	......	3,900,403	238,136	1,395,097	5,533,636
......	1,068,771	92,895	1,161,666	1,808,464	......	4,269,323	192,423	1,669,715	6,131,461
......	703,837	116,974	820,811	1,995,574	......	3,750,257	111,134	1,310,525	5,171,916
......	857,003	215,901	1,072,904	1,817,058	......	[b]4,350,011	193,105	1,596,213	6,139,329
585,001	11,709,100	3,869,564	16,163,665	19,793,868	1,475,969	79,952,814	18,092,155	22,991,265	121,036,234

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[b] Includes 138,926 tons used on line of Cumberland and Pennsylvania Railroad and its branches, and at Cumberland and Piedmont; also 349,868 tons used by the Baltimore and Ohio Railroad Company in locomotives, rolling mills, etc.

MICHIGAN.

Total production in 1901, 1,241,241 short tons; spot value, $1,753.064.

The development of the coal-mining industry in Michigan during the last five years has been one of the most notable records contained in this report, and may be directly attributed to the growth of manufacturing cities along the lower Great Lakes. Prior to 1897 Michigan had not developed to any extent as a coal producer, the largest output having been reported in 1882, when it was 135,339 short tons. In the following year it fell off nearly 50 per cent, and in 1884 it had dropped to 36,712 tons. It did not reach a total exceeding 100,000 tons until 1895, in which year it amounted to 112,322 tons, and dropped again in 1896 to 92,882 tons. With the return of prosperous times and the increasing manufacturing activity on the lake ports, already referred to, attention was directed to the heretofore practically undeveloped coal resources of the State, and active exploitation began, with the result that in 1897 the production increased to 223,592 short tons, and has increased with almost unprecedented rapidity until in 1901 it reached a total of 1,241,241 tons, nearly six times that of 1897, and more than thirteen times that of 1896. Most of the development work has been carried on in Saginaw County, which produced in 1901 a total of 938,042 tons, an increase of more than 50 per cent over the preceding year.

The production of the State in 1900 and 1901, by counties, and the distribution of the product for consumption are shown in the following tables:

Coal production of Michigan in 1900, by counties.

County.	Loaded at mines for shipment.	Sold to local trade and used by employees.	Used at mines for steam and heat.	Total production.	Total value.	Average price per ton.	Average number of days active.	Average number of employees.
	Short tons.	*Short tons.*	*Short tons.*	*Short tons.*				
Bay	167,428	13,894	9,492	190,814	$283,184	$1.48	274	436
Eaton	....	4,530	....	4,530	8,770	1.94	224	17
Genesee and Huron	3,678	1,298	1,277	6,253	11,442	1.83	220	20
Jackson	3,997	17,676	1,644	23,317	43,388	1.86	254	81
Saginaw	594,127	2,860	4,125	601,112	872,486	1.45	260	1,087
Shiawassee	23,449	....	....	23,449	40,413	1.72	223	63
Total	792,679	40,258	16,538	849,475	1,259,683	1.48	261	1,704

Coal production of Michigan in 1901, by counties.

County.	Loaded at mines for shipment.	Sold to local trade and used by employees.	Used at mines for steam and heat.	Total production.	Total value.	Average price per ton.	Average number of days active.	Average number of employees.
	Short tons.	*Short tons.*	*Short tons.*	*Short tons.*				
Bay	225,765	16,805	11,251	253,821	$388,474	$1.53	232	549
Eaton	....	4,753	50	4,803	9,071	1.89	255	23
Genesee and Huron	3,894	1,668	2,288	7,850	14,171	1.81	241	40
Jackson	1,853	17,187	1,248	20,288	38,576	1.90	270	52
Saginaw	910,147	4,336	23,559	938,042	1,275,331	1.36	252	1,570
Shiawassee	16,437	....	....	16,437	27,441	1.67	210	42
Total	1,158,096	44,749	38,396	1,241,241	1,753,064	1.41	247	2,276

The following tables exhibit the distribution of the product during the last ten years, and the total output of the State since 1877:

Distribution of the coal product of Michigan for ten years from 1892 to 1901, inclusive.

Year.	Loaded at mines for shipment.	Sold to local trade and used by employees.	Used at mines for steam and heat.	Total product.	Total value.	Average price per ton.	Average number of days active.	Average number of employees.
	Short tons.	*Short tons.*	*Short tons.*	*Short tons.*				
1892	27,200	45,180	5,610	77,990	$121,314	$1.56	230	195
1893	27,787	16,367	1,825	45,979	82,462	1.79	154	162
1894	60,817	7,055	2,150	70,022	103,049	1.47	224	223
1895	80,403	27,019	4,900	112,322	180,016	1.60	186	320
1896	83,150	6,547	3,185	92,882	150,631	1.62	157	320
1897	188,636	24,686	10,270	223,592	325,416	1.46	230	537
1898	232,155	75,622	7,945	315,722	462,711	1.47	245	715
1899	574,280	34,191	16,237	624,708	870,152	1.39	232	1,291
1900	792,679	40,258	16,538	849,475	1,259,683	1.48	261	1,709
1901	1,158,096	44,749	38,396	1,241,241	1,753,064	1.41	247	2,276

The annual record of coal production in Michigan for such years as the statistics have been obtained is shown in the following table:

Coal production of Michigan from 1877 to 1901, inclusive.

[Short tons.]

Year.	Quantity.	Year.	Quantity.
Previous to 1877	350,000	1889	67,431
1877	69,197	1890	74,977
1878	85,322	1891	80,307
1879	82,015	1892	77,990
1880	129,053	1893	45,979
1881	130,130	1894	70,022
1882	135,339	1895	112,322
1883	71,296	1896	92,882
1884	36,712	1897	223,592
1885	45,178	1898	315,722
1886	60,434	1899	624,708
1887	71,461	1900	849,475
1888	81,407	1901	1,241,241

MISSOURI.

Total production in 1901, 3,802,088 short tons; spot value, $4,707,164.

As compared with 1900, the production of Missouri in 1901 shows an increase of 261,985 short tons, or 7.4 per cent. The value increased $426,836, or not quite 10 per cent.

As has been stated in previous reports, the history of the coal production of Missouri may be considered as a fairly accurate record of the industrial conditions in the State. Its product is confined almost entirely to local markets, little, if any, coal being shipped outside of the State. The proximity of the coal fields of Iowa on the north, Illinois on the east, Arkansas and Indian Territory on the south and southwest, and Kansas on the west restrict the product of the State to consumption within its borders. St. Louis and the other cities along the Mississippi River are supplied principally from the more cheaply mined coals of Illinois, and the mines of the State have not obtained much benefit from the increased activity in the manufacturing cities in the eastern part of the State.

The production by counties during 1900 and 1901, and the distribution of the product for consumption are shown in the following tables:

Coal production of Missouri in 1900, by counties.

County.	Loaded at mines for shipment.	Sold to local trade and used by employees.	Used at mines for steam and heat.	Total production.	Total value.	Average price per ton.	Average number of days active.	Average number of employees.
	Short tons.	*Short tons.*	*Short tons.*	*Short tons.*				
Adair	237,185	5,429	1,700	244,314	$312,305	$1.28	215	493
Audrain	18,996	24,257	821	44,074	61,040	1.38	205	130
Barton	158,491	5,811	2,290	166,592	208,365	1.25	280	312
Bates	257,681	8,912	4,119	270,712	264,348	.98	172	479
Boone	6,500	12,107	12	18,619	24,288	1.30	216	52
Caldwell	22,000	9,800	2,300	34,100	55,050	1.61	228	94
Callaway	....	16,410	25	16,435	29,730	1.81	192	61
Henry	71,400	9,292	318	81,010	118,772	1.47	219	287
Johnson	4,039	900	....	4,939	4,602	.93	176	15
Lafayette	432,472	17,872	7,514	457,858	740,561	1.62	187	1,486
Linn	55,619	14,946	746	71,311	116,532	1.63	209	240
Macon	816,657	5,750	13,841	836,248	844,616	1.01	239	1,676
Putnam	108,891	1,014	1,721	111,626	149,543	1.34	221	356
Ralls	19,472	548	125	20,145	23,046	1.14	249	55
Randolph	412,673	17,132	12,651	442,456	464,213	1.05	215	903
Ray	207,085	5,195	4,337	216,617	282,299	1.30	199	815
Vernon	316,863	1,101	4,863	322,827	311,297	.96	228	443
Chariton, Grundy, and Livingston	32,424	7,278	997	40,699	79,008	1.94	193	190
Howard and Jackson	7,375	8,900	1,100	17,375	47,400	2.73	251	84
Montgomery and Morgan	1,371	575	200	2,146	3,313	1.54	186	9
Small mines	....	120,000	....	120,000	140,000	....	....	....
Total	3,187,194	293,229	59,680	3,540,103	4,280,328	1.21	214	8,180

Coal production of Missouri in 1901, by counties.

County.	Loaded at mines for shipment.	Sold to local trade and used by employees.	Used at mines for steam and heat.	Total production.	Total value.	Average price per ton.	Average number of days active.	Average number of employees.
	Short tons.	*Short tons.*	*Short tons.*	*Short tons.*				
Adair	327,615	28,749	1,647	358,011	$433,654	$1.21	175	769
Audrain	26,387	9,202	327	35,916	51,414	1.43	222	91
Barton	140,858	1,302	2,194	144,354	178,358	1.24	275	307
Bates	261,803	13,462	5,755	281,020	289,850	1.03	208	512
Boone	6,000	16,209	420	22,629	34,170	1.51	253	55
Caldwell	13,000	5,430	2,000	20,430	34,235	1.68	278	105
Callaway	1,920	25,592	496	28,008	43,808	1.56	223	75
Henry	67,109	15,442	35	82,586	128,609	1.56	229	214
Johnson	....	11,255	....	11,255	16,648	1.48	183	46
Lafayette	408,559	22,394	7,969	438,922	711,532	1.62	184	1,638
Linn	68,150	16,438	668	85,256	137,284	1.61	234	255
Macon	1,018,360	7,858	14,758	1,040,976	1,053,056	1.01	218	2,523
Putnam	129,699	2,524	1,174	133,397	182,991	1.37	231	423
Ralls	22,838	700	150	23,688	28,834	1.22	218	60
Randolph	386,696	9,270	7,437	403,403	461,983	1.15	227	905
Ray	254,464	7,571	5,397	267,432	394,070	1.47	177	1,129
Vernon	231,825	1,220	5,025	238,070	244,610	1.02	207	483
Chariton, Grundy, and Livingston	34,962	6,822	1,477	43,261	86,547	2.00	228	168
Howard and Jackson	8,375	10,425	1,200	20,000	50,000	2.50	260	100
Montgomery and Morgan	2,503	867	104	3,474	5,511	1.59	138	13
Small mines	....	120,000	....	120,000	140,000	......	....	....
Total	3,411,123	332,732	58,233	3,802,088	4,707,164	1.24	223	9,871

The distribution of the coal product of Missouri from 1899 to 1901, inclusive, is shown in the following table:

Distribution of the coal product of Missouri from 1889 to 1901, inclusive.

Year.	Loaded at mines for shipment.	Sold to local trade and used by employees.	Used at mines for steam and heat.	Total product.	Total value.	Average price per ton.	Average number of days active.	Average number of employees.
	Short tons.	*Short tons.*	*Short tons.*	*Short tons.*				
1889	2,246,845	275,999	34,979	2,557,828	$3,479,057	$1.36	....	....
1890	2,449,305	240,237	45,679	2,735,221	3,382,858	1.24	229	5,971
1891	2,350,707	265,595	58,304	2,674,606	3,283,242	1.23	218	6,199
1892	2,399,605	293,414	40,930	2,733,949	3,369,659	1.23	230	5,893
1893	2,525,227	322,754	49,461	2,897,442	3,562,757	1.23	206	7,375
1894	1,955,255	242,501	47,283	2,245,039	2,634,564	1.17	138	7,523
1895	2,104,452	231,090	36,851	2,372,393	2,651,612	1.12	163	6,299
1896	2,047,251	243,029	41,262	2,331,542	2,518,194	1.08	168	5,082
1897	2,384,797	239,686	41,143	2,665,626	2,887,884	1.08	168	6,414
1898	2,393,315	249,662	45,344	2,688,321	2,871,296	1.07	198	6,542
1899	2,691,433	289,826	44,555	3,025,814	3,591,945	1.20	212	7,136
1900	3,187,194	293,229	59,680	3,540,103	4,280,328	1.21	214	8,180
1901	3,411,123	332,732	58,233	3,802,088	4,707,164	1.24	223	9,871

The following table shows the production, by counties, for the last five years, with the increases and decreases in 1901 as compared with 1900:

Coal production in Missouri since 1896, by counties.

[Short tons.]

County.	1897.	1898.	1899.	1900.	1901.	Increase, 1901.	Decrease, 1901.
Adair	33, 811	74, 796	175, 452	244, 314	358, 011	113, 697	....
Audrain	45, 972	30, 976	45, 907	44, 074	35, 916	....	8, 158
Barton	54, 400	70, 551	111, 468	166, 592	144, 354	....	22, 238
Bates	335, 778	318, 973	456, 797	270, 712	281, 020	10, 308	....
Boone	9, 180	13, 779	20, 280	18, 619	22, 629	4, 010	....
Caldwell	40, 800	25, 000	48, 100	34, 100	20, 430	....	13, 670
Callaway	29, 118	21, 215	23, 210	16, 435	28, 008	11, 573	....
Cole	2, 500	2, 000	2, 500	....	....	....	....
Grundy	40, 508	39, 532	42, 071	39, 239	42, 361	3, 122	....
Henry	44, 276	39, 082	95, 071	81, 010	82, 586	1, 576	....
Jackson	17, 674	40, 000	32, 000	16, 700	20, 000	3, 300	....
Johnson	....	3, 700	1, 500	4, 939	11, 255	6, 316	....
Lafayette	325, 798	301, 066	369, 253	457, 858	438, 922	....	18, 936
Linn	81, 598	68, 643	84, 928	71, 311	85, 256	13, 945	....
Livingston	....	4, 500	1, 150	1, 200	900	....	300
Macon	573, 556	742, 413	539, 543	836, 248	1, 040, 976	204, 728	....
Montgomery and Morgan	25, 865	1, 200	1, 855	2, 146	3, 474	1, 328	....
Pettis	800	....	....	....	....	....	....
Putnam	102, 922	117, 059	134, 655	111, 626	133, 397	21, 771	....
Ralls	8, 700	7, 980	22, 640	20, 145	23, 688	3, 543	....
Randolph	311, 099	253, 558	304, 962	442, 456	403, 403	....	39, 053
Ray	182, 240	210, 961	206, 622	216, 617	267, 432	50, 815	....
Vernon	279, 031	181, 337	185, 214	322, 827	238, 070	....	84, 757
Other counties and small mines	120, 000	120, 000	120, 636	120, 935	120, 000	....	935
Total	2, 665, 626	2, 688, 321	3, 025, 814	3, 540, 103	3, 802, 088	[a]261, 985	....

[a] Net increase.

The annual production since 1873 has been as follows:

Coal production of Missouri since 1873.

[Short tons.]

Year.	Quantity.	Year.	Quantity.
1873	784, 000	1888	3, 909, 967
1874	789, 680	1889	2, 557, 823
1875	840, 000	1890	2, 735, 221
1876	1, 008, 000	1891	2, 674, 606
1877	1, 008, 000	1892	2, 773, 949
1878	1, 008, 000	1893	2, 897, 442
1879	1, 008, 000	1894	2, 245, 039
1880	1, 680, 000	1895	2, 372, 393
1881	1, 960, 000	1896	2, 331, 542
1882	2, 240, 000	1897	2, 665, 626
1883	2, 520, 000	1898	2, 688, 321
1884	2, 800, 000	1899	3, 025, 814
1885	3, 080, 000	1900	3, 540, 103
1886	1, 800, 000	1901	3, 802, 088
1887	3, 209, 916		

MONTANA.

Total production in 1901, 1,396,081 short tons; spot value, $2,009,316.

Montana was one of the five States whose production in 1901 was less than that of 1900. There was only one county in the State in which the output last year was greater than the preceding one. The one exception was Carbon County, in which the production increased 104,683 short tons. During 1901 the Sand Coulee mines, which have been one of the most important producers in the State, were practically abandoned, with the result that the production of Cascade County decreased 333.988 tons. The total loss experienced in other counties amounted to a little more than 36,000 tons, making a gross loss of about 370,000 tons. The gain of 104,683 tons in Carbon County reduced the net loss to 265,694 tons, or about 16 per cent. The natural result of this large decrease was that the total production in 1901 was less than in any year since 1894. The value decreased from $2,713,707 in 1900 to $2,009,316 in 1901, a loss of $704,391, or more than 25 per cent. The average price per ton declined from $1.63 in 1900 to $1.44 in 1901. The total number of men employed in 1901 was 2,158, as compared with 2,376 in 1900. They made an average of 231 days in 1901 as against 252 days in 1900.

The production, by counties, in 1900 and 1901, together with the distribution of the product for consumption, and the statistics of labor employed, are shown in the following tables:

Coal production of Montana in 1900, by counties.

County.	Loaded at mines for shipment.	Sold to local trade and used by employees.	Used at mines for steam and heat.	Made into coke.	Total production.	Total value.	Average price per ton.	Average number of days active.	Average number of employees.
	Short tons.	*Short tons.*	*Short tons.*	*Short tons.*	*Short tons.*				
Carbon	381,672	6,163	6,042	....	393,877	$519,015	$1.32	258	610
Cascade	1.002,884	12,747	48.588	59,176	1.123.395	1,836,382	1.63	257	1,322
Choteau	....	5,679	78	....	5,757	14,838	2.58	117	33
Park	9,900	875	775	74,475	86,025	255,700	2.97	232	315
Fergus, Gallatin, Granite, and Lewis and Clarke	51,000	1,350	371	....	52,721	87,772	1.66	244	96
Total	1,445,456	26,814	55,854	133,651	1,661,775	2,713,707	1.63	252	2,376

Coal production of Montana in 1901, by counties.

County.	Loaded at mines for shipment.	Sold to local trade and used by employees.	Used at mines for steam and heat.	Made into coke.	Total production.	Total value.	Average price per ton.	Average number of days active.	Average number of employees.
	Short tons.	*Short tons.*	*Short tons.*	*Short tons.*	*Short tons.*				
Carbon	468,124	18,632	11,804	....	498,560	$617,639	$1.24	217	842
Cascade	709,558	14,266	27,770	37,813	789,407	1,191,783	1.51	243	1,065
Choteau	1,120	3,900	30	....	5,050	13,210	2.62	158	23
Park	7,800	3,844	1,200	65,137	77,981	144,254	1.85	224	161
Fergus, Gallatin, Granite, and Lewis and Clarke	24,063	200	820	....	25,083	42,430	1.69	258	67
Total	1,210,665	40,842	41,624	102,950	1,396,081	2,009,316	1.44	231	2,158

The distribution of the product for consumption during the last thirteen years has been as follows:

Distribution of the coal product of Montana from 1889 to 1901, inclusive.

Year.	Loaded at mines for shipment.	Sold to local trade and used by employees.	Used at mines for steam and heat.	Made into coke.	Total product.	Total value.	Average price per ton.	Average number of days active.	Average number of employees
	Short tons.	*Short tons.*	*Short tons.*	*Short tons.*	*Short tons.*				
1889	314,372	12,917	5,436	30,576	363,301	$880,773	$2.42	....	....
1890	466,016	23,427	4,034	24,000	517,477	1,252,492	2.42	....	1,251
1891	501,503	5,395	6,438	28,525	541,861	1,228,630	2.27	....	1,119
1892	521,521	4,866	1,849	36,412	564,648	1,330,847	2.36	258	1,158
1893	789,516	27,063	17,960	57,770	892,309	1,772,116	1.99	242	1,401
1894	861,171	12,900	17,324	36,000	927,395	1,887,390	2.04	192	1,782
1895	1,404,862	19,168	20,463	59,700	1,504,193	2,850,906	1.89	223	2,184
1896	1,314,873	27,476	17,676	183,420	1,543,445	2,279,672	1.47	234	2,335
1897	1,434,858	29,707	18,410	164,907	1,647,882	2,897,408	1.76	252	2,337
1898	1,261,814	29,493	19,386	169,110	1,479,803	2,324,207	1.57	216	2,359
1899	1,294,614	29,686	34,249	137,902	1,496,451	2,347,757	1.57	238	2,378
1900	1,445,456	26,814	55,854	133,651	1,661,775	2,713,707	1.63	252	2,376
1901	1,210,665	40,842	41,624	102,950	1,396,081	2,009,316	1.44	231	2,158

In the following table is presented a statement of the coal production in Montana since 1897, with the increases and decreases in 1901, as compared with 1900:

Production of coal in Montana since 1897, by counties.

[Short tons.]

County.	1897.	1898.	1899.	1900.	1901.	Increase, 1901.	Decrease, 1901.
Carbon	245,761	272,396	337,525	393,877	498,560	104,683	....
Cascade	1,138,590	988,821	965,378	1,123,395	789,407	....	333,988
Choteau	4,845	6,537	6,885	5,757	5,050	....	707
Fergus	....	950	900	900	500	....	400
Gallatin	132,413	63,626	56,671	51,671	24,583	....	27,088
Dawson	2,800	....	....	....	....	....	....
Lewis and Clarke	....	319	....	....	....	....	....
Meagher	584	....	....	....	....	....	....
Park	122,889	147,154	128,850	86,025	77,981	....	8,044
Other counties	....	....	242	150	....	....	150
Total	1,647,882	1,479,803	1,496,451	1,661,775	1,396,081	....	[a]265,694

[a] Net decrease.

Since 1883 the total production of the State has been as follows:

Coal production of Montana since 1883.

Year.	Quantity.	Value.	Year.	Quantity.	Value.
	Short tons.			*Short tons.*	
1883	19,795	....	1893	892,309	$1,772,116
1884	80,376	....	1894	927,395	1,887,390
1885	86,440	....	1895	1,504,193	2,850,906
1886	49,846	....	1896	1,543,445	2,279,672
1887	10,202	....	1897	1,647,882	2,897,408
1888	41,467	....	1898	1,479,803	2,324,207
1889	363,301	....	1899	1,496,451	2,347,757
1890	517,477	$1,252,492	1900	1,661,775	2,713,707
1891	541,861	1,228,630	1901	1,396,081	2,009,316
1892	564,648	1,330,847			

NEBRASKA.

The southeastern counties of Nebraska contain a portion of the Iowa and Missouri coal fields, but no veins of workable thickness have been developed in this State. Where found they have been pinched to thin seams varying from 6 to 22 inches. Small amounts of coal have been mined in the State from time to time for local consumption, but with the increasing competition of Iowa, Kansas, and Missouri coals, in all of which States conditions are much more favorable, both as to the quality of the coal and the economical mining of it, no encouragement has been given to the development of the Nebraska areas.

No production has been reported from this State since 1897, when about 500 tons were mined. The discovery of a vein 2 feet in thickness was reported near Beatrice in the early part of 1901. It created some excitement at the time, but no production was reported from there during the year.

NEVADA.

Reports of coal discoveries in this State have been made from time to time, and some areas are known to exist, but on account of the poor quality of the coal and lack of profitable market attempts to mine it have not been successful. A small amount (150 tons) was mined in Esmeralda county in 1894, since which date no output has been reported.

NEW MEXICO.

Total production in 1901, 1,086,546 short tons; spot value, $1,546,652.

As compared with 1900, the coal production of New Mexico in 1901 decreased 212,753 short tons, or 16.3 per cent.

The counties in which the principal losses occurred were Colfax, whose production decreased 139,184 short tons, or 36 per cent, and Santa Fe, whose production fell off 138,777 tons, or about 52 per cent. McKinley County, formerly Bernalillo, though somewhat disturbed by strikes during the year, increased its production 65,887 tons, or about 14 per cent.

There were seven mines in which strikes occurred during the year. Four of these were the Rocky Cliff mine, and the Gallup, Catalpa, and Weaver mines of the Colorado Fuel and Iron Company. In the former mine the strike lasted for ten months; in the Gallup mine 206 men were idle for 56 days; in the Catalpa mine 123 men were idle for 22 days, and in the Weaver mine 120 men were idle for 64 days.

The attempts to use mining machines in the coal mines of New Mexico have not proved successful. There are several mines that are equipped for operating machines, and as many as thirty-one have been installed.

There were 21 machines in operation in 1900, and 12,000 tons were mined by their use in that year. In 1901, 31 machines were reported as a part of the mine equipment, but only 6 were in use, and they produced only 2,700 tons.

The details of production in the last two years have been as follows:

Coal production of New Mexico in 1900, by counties.

County.	Loaded at mines for shipment.	Sold to local trade and used by employees.	Used at mines for steam and heat.	Made into coke.	Total production.	Total value.	Average price per ton.	Average number of days active.	Average number of employees.
	Short tons.	*Short tons.*	*Short tons.*	*Short tons.*	*Short tons.*				
Bernalillo	425,864	3,630	21,152	....	450,646	$610,556	$1.35	258	811
Colfax	348,164	5,595	7,388	27,333	388,480	432,146	1.11	278	410
Lincoln	143,479	3,998	2,965	....	150,442	300,884	2.00	277	223
Rio Arriba	44,000	1,200	600	....	45,800	62,900	1.37	275	74
San Juan Santa Fe Socorro	236,782	1,151	25,998	....	263,931	369,684	1.41	244	519
Total	1,198,289	15,574	58,103	27,333	1,299,299	1,776,170	1.37	261	2,037

Coal production of New Mexico in 1901, by counties.

County.	Loaded at mines for shipment.	Sold to local trade and used by employees.	Used at mines for steam and heat.	Made into coke.	Total production.	Total value.	Average price per ton.	Average number of days active.	Average number of employees.
	Short tons.	*Short tons.*	*Short tons.*	*Short tons.*	*Short tons.*				
Bernalillo-McKinley	499,328	2,072	15,133	....	516,533	$696,085	$1.35	240	1,170
Colfax	222,861	5,861	6,279	14,295	249,296	262,225	1.05	163	800
Lincoln	148,018	5,700	2,903	....	156,621	310,742	1.98	288	188
Rio Arriba	37,417	825	700	....	38,942	54,150	1.39	237	49
San Juan Santa Fe Socorro	115,386	1,166	8,602	....	125,154	223,450	1.79	289	271
Total	1,023,010	15,624	33,617	14,295	1,086,546	1,546,652	1.42	224	2,478

The following table illustrates how the product of the Territory has been distributed for consumption during the last thirteen years, its total value, with the number of men employed and the average number of days worked:

Distribution of the coal product of New Mexico from 1889 to 1901, inclusive.

Year.	Loaded at mines for shipment.	Sold to local trade and used by employees.	Used at mines for steam and heat.	Made into coke.	Total product.	Total value.	Average price per ton.	Average number of days active.	Average number of employees.
	Short tons.	*Short tons.*	*Short tons.*	*Short tons.*	*Short tons.*				
1889	466,127	8,953	6,383	6,000	487,463	$870,468	$1.79	....	....
1890	358,332	11,360	6,085	....	375,777	504,390	1.34	192	827
1891	448,612	3,471	6,245	4,000	462,328	779,018	1.68	265	806
1892	645,557	8,776	6,997	....	661,330	1,074,601	1.62	223	1,083
1893	636,002	5,618	8,776	14,698	665,094	979,044	1.47	229	1,011
1894	561,523	8,266	14,365	13,042	597,196	935,857	1.57	182	985
1895	695,634	13,045	11,292	683	720,654	1,072,520	1.49	190	1,383
1896	607,319	6,677	7,446	1,184	622,626	930,381	1.49	172	1,559
1897	689,423	7,844	19,714	....	716,981	991,611	1.38	208	1,659
1898	949,903	7,660	17,601	17,124	992,288	1,344,750	1.35	242	1,873
1899	1,021,801	14,128	14,785	....	1,050,714	1,461,865	1.39	257	1,750
1900	1,198,289	15,574	58,103	27,333	1,299,299	1,776,170	1.37	261	2,037
1901	1,023,010	15,624	33,617	14,295	1,086,546	1,546,652	1.42	224	2,478

Although the production in 1901 was more than 200,000 tons less than 1900, it was, with that single exception, the largest production ever reported. The development of the industry since 1890 has been noteworthy.

The following tables show the production in the Territory, by counties, since 1897, with the increases and decreases in 1901, as compared with 1900, and the total production of the Territory since 1882, in which year the first output was reported:

Coal production of New Mexico since 1897, by counties.

[Short tons.]

County.	1897.	1898.	1899.	1900.	1901.	Increase, 1901.	Decrease, 1901.
Bernalillo	332,488	445,558	493,310	450,646	516,533	65,887	....
Colfax	163,463	269,215	368,373	388,480	249,296	....	139,184
Lincoln	75	....	12,737	150,442	156,621	6,179	....
Rio Arriba	[a] 12,300	31,000	32,000	45,800	38,942	....	6,858
Santa Fe	208,655	246,215	137,534	252,731	106,454	....	146,277
Other counties	....	300	6,760	11,200	18,700	7,500	....
Total	716,981	992,288	1,050,714	1,299,299	1,086,546	....	[b] 212,753

[a] Including San Juan County.

[b] Net decrease.

Coal production of New Mexico since 1882.

Year.	Quantity.	Value.	Year.	Quantity.	Value.
	Short tons.			*Short tons.*	
1882	157,092	....	1892	661,330	$1,074,251
1883	211,347	....	1893	665,094	979,044
1884	220,557	....	1894	597,196	935,867
1885	306,202	$918,606	1895	720,654	1,072,520
1886	271,285	813,855	1896	622,626	930,381
1887	508,034	1,524,102	1897	716,981	991,611
1888	626,665	1,879,995	1898	992,288	1,344,750
1889	486,943	872,628	1899	1,050,714	1,461,865
1890	375,777	504,390	1900	1,299,299	1,776,170
1891	462,328	779,018	1901	1,086,546	1,546,652

NORTH CAROLINA.

Total production in 1901, 12,000 short tons; spot value, $15,000.

The entire production of North Carolina in 1901, as for several years past, has been from the Cumnock mines, in Chatham County. The endeavor to operate these mines has been attended with great difficulty, and the product during the last two years has decreased considerably. The production in 1901 was less than one-half of that of 1899, and nearly one-third less than that of 1900.

Coal production of North Carolina for eleven years from 1891 to 1901, inclusive.

Year.	Loaded at mines for shipment.	Sold to local trade and used by employees.	Used at mines for steam and heat.	Total production.	Total value.	Average price per ton.	Average number of days active.	Average number of employees.
	Short tons.	*Short tons.*	*Short tons.*	*Short tons.*				
1891	18,780	600	975	20,355	$39,635	$1.93	254	80
1892	6,679	....	....	6,679	9,599	1.44	160	90
1893	15,000	....	2,000	17,000	25,500	1.50	80	70
1894	13,500	1,000	2,400	16,900	29,675	1.76	145	95
1895	23,400	600	900	24,900	41,350	1.66	226	61
1896	5,356	295	2,162	7,813	11,720	1.50	220	18
1897	21,280	....	....	21,280	27,000	1.34	215	51
1898	9,852	304	1,339	11,495	14,368	1.25	....	....
1899	24,126	486	2,284	26,896	34,965	1.30	210	70
1900	14,757	492	2,485	17,734	23,447	1.32	151	84
1901	10,000	....	2,000	12,000	15,000	1.25	300	25

The history of coal mining in the State dates from 1889. The Egypt mines, now called the Cumnock, were opened in December of that year, and yielded 192 tons. Since that time the product annually has been as follows:

Coal production of North Carolina since 1889.

Year.	Quantity.	Value.	Year.	Quantity.	Value.
	Short tons.			*Short tons.*	
1889	192	$451	1896	7,813	$11,720
1890	10,262	17,864	1897	21,280	27,000
1891	20,355	39,635	1898	11,495	14,368
1892	6,679	9,599	1899	26,896	34,965
1893	17,000	25,500	1900	17,734	23,447
1894	16,900	29,675	1901	12,000	15,000
1895	24,900	41,350			

NORTH DAKOTA.

Total production in 1901, 166,601 short tons; spot value, $214,151.

The strenuous efforts made by the State government of North Dakota to effect the utilization of the lignite coals of the State appear to be meeting with deserved success. In order to encourage the exploitation of the coal resources of the State, the legislature enacted a law a few years since compelling all State institutions to purchase coal mined in the State. The effect of this attempt to encourage home industry is shown by the fact that, whereas in 1895 the production amounted to less than 41,000 tons, and had not attained as much as 50,000 tons in any preceding year, it reached a total of 129,883 tons in 1900 and was again increased to 166,601 tons in 1901. The value of the product has increased in somewhat greater proportion, the average price having increased each year since 1897, when it was $1.08. In 1901 the average price was $1.29, the highest ever reached since 1891. As compared with 1900 the production last year increased 36,718 short tons, or 28 per cent, and the value increased $55,803, or 35 per cent.

The principal development in the State during the last year has been at the Wilton mine of the Bismarck, Washington, and Great Falls Railway, in Burleigh County. The coal of this mine, like that of all in the State, is lignite. The vein is said to be 14 feet in thickness, 9 feet of which are workable, 4 feet of coal being left to support the roof. This mine is one in which the development and installation is according to the latest improved practice. All the coal is mined by the use of electric machines, five chain breast and one long wall machine being in operation. It is hauled to the surface by electric locomotives. Electric mining machines are also to be installed in the mines of the Kenmare Diamond Coal Company and the Kenmare Dry Coal and Manufacturing Company, at Kenmare, in Ward County.

Of the total production in 1901, 43,574 tons were mined by the use of machines, as compared with 33,965 tons mined by machines in 1900, and 38,066 tons in 1899. There were 7 machines in use in 1900 and 1901, and 5 machines in 1899.

The statistics of production are shown in the following tables:

Coal production of North Dakota in 1900, by counties.

County.	Loaded at mines for shipment.	Sold to local trade and used by employees.	Used at mines for steam and heat.	Total production.	Total value.	Average price per ton.	Average number of days active.	Average number of employees.
	Short tons.	*Short tons.*	*Short tons.*	*Short tons.*				
Burleigh and Emmons	6,000	3,425	185	9,610	$10,385	$1.08	55	69
McLean	....	3,154	....	3,154	4,374	1.39	142	14
Morton	23,553	3,540	335	27,428	28,880	1.05	163	57
Stark	26,000	2,050	1,000	29,050	28,390	.98	219	39
Ward	51,031	9,560	50	60,641	86,319	1.42	155	147
Total	106,584	21,729	1,570	129,883	158,348	1.22	142	326

Coal production of North Dakota in 1901, by counties.

County.	Loaded at mines for shipment.	Sold to local trade and used by employees.	Used at mines for steam and heat.	Total production.	Total value.	Average price per ton.	Average number of days active.	Average number of employees.
	Short tons.	*Short tons.*	*Short tons.*	*Short tons.*				
Burleigh and Emmons	35,836	4,306	4,712	44,854	$50,111	$1.12	285	69
McLean and Oliver	....	1,516	....	1,516	3,016	1.99	275	4
Morton	48,250	4,300	300	52,850	64,035	1.21	170	68
Stark	16,650	2,050	....	18,700	19,237	1.03	193	25
Ward	33,928	14,603	150	48,681	77,752	1.60	160	114
Total	134,664	26,775	5,162	166,601	214,151	1.29	198	280

Distribution of the coal product of North Dakota from 1889 to 1901, inclusive.

Year.	Loaded at mines for shipment.	Sold to local trade and used by employees.	Used at mines for steam and heat.	Total product.	Total value.	Average price per ton.	Average number of days active.	Average number of employees.
	Short tons.	*Short tons.*	*Short tons.*	*Short tons.*				
1889	18,610	10,297	....	28,907	$41,431	$1.43	....	....
1890	....	30,000	....	30,000	42,000	1.40	....	....
1891	....	30,000	....	30,000	42,000	1.40	....	....
1892	38,000	2,725	....	40,725	39,250	.96	216	54
1893	47,968	1,612	50	49,630	56,250	1.13	193	88
1894	37,311	4,480	224	42,015	47,049	1.12	156	77
1895	35,380	3,617	....	38,997	41,646	1.07	143	62
1896	71,447	6,183	420	78,050	84,908	1.09	166	141
1897	65,032	10,458	1,756	77,246	83,803	1.08	168	170
1898	71,223	11,525	1,147	83,895	93,591	1.12	187	151
1899	77,731	20,788	290	98,809	117,500	1.19	154	210
1900	106,584	21,729	1,570	129,883	158,348	1.22	142	326
1901	134,664	26,775	5,162	166,601	214,151	1.29	198	280

Coal production of North Dakota since 1884.

[Short tons.]

Year.	Quantity.	Year.	Quantity.
1884	35,000	1893	49,630
1885	25,000	1894	42,015
1886	25,955	1895	38,997
1887	21,470	1896	78,050
1888	34,000	1897	77,246
1889	28,907	1898	83,895
1890	30,000	1899	98,809
1891	30,000	1900	129,883
1892	40,725	1901	166,601

OHIO.

Total production in 1901, 20,943,807 short tons; spot value, $20,928,158.

Ohio continued to occupy fourth place among the coal-producing States, and until displaced by West Virginia in 1896 was third. When the value of the product, however, is considered, Ohio holds third place. In 1900, the output of West Virginia exceeded that of Ohio by 3,659,057 tons, whereas the value of Ohio's product exceeded that of West Virginia by $875,000. Last year the value of Ohio's product exceeded that of West Virginia by about $80,000. As compared with 1900, the coal production of Ohio in 1901 shows an increase of 1,955,657 short tons, or 10.3 per cent. The gain in 1900 over 1899 was 2,487,880 short tons, or 15 per cent, and in 1899 over 1898 the gain was 1,983,403 short tons. So that the total increase in 1901 over 1898 amounted to 6,426,940 short tons, or over 44 per cent. The value of the product in 1901 exceeded that of 1900 by $1,635,912, or about 8.5 per cent. Compared with 1898, it shows an increase of $8,900,822, or about 74 per cent. The average price per ton declined from $1.02 in 1900, to $1 in 1901, and this average for last year was, with the exception of that in 1900, the highest in thirteen years.

The amount of coal mined by the use of machines in 1901 amounted to 9,908,316 short tons, as compared with 8,835,743 short tons in 1900, and 6,822,524 short tons in 1899. The total number of machines used last year was 376, as compared with 341 in 1900, and 278 in 1899. The percentage of machine-mined tonnage to the total product of Ohio was in 1901, 47.30; in 1900, 46.53; and in 1899, 41.35.

There were 5 counties in Ohio whose production in 1901 exceeded a total of 2,000,000 tons each. These were Athens, Guernsey, Hocking, Jackson, and Perry. Three others—Belmont, Jefferson, and Tuscarawas—exceeded 1,000,000 tons. Stark County, whose product exceeded 1,000,000 tons in 1900, fell off to 896,996 tons in 1901. The principal increases in production last year were shown in Athens, Guernsey, Hocking, Tuscarawas, and Belmont counties in the order named. The principal decreases were borne by Stark and Jackson counties. Athens, Hocking, and Perry counties combined form what is properly known as the Hocking Valley region. The output in these three counties in 1901 amounted to 8.184,364 short tons, or nearly 40 per cent of the total output of the State. In 1900 the Hocking Valley region produced a total of 7.166.916 tons, or nearly 38 per cent of the State's output, and in 1899 this region was credited with an output of 5,540,393 short tons, or 33⅓ per cent of the total. The increase of the Hocking Valley region in 1901 over 1900 was 1,017.448 short tons, or 57 per cent of the total increase in the State.

Details of production, by counties, in 1900 and 1901, together with the distribution of the product for consumption, are presented in the following tables:

Coal production of Ohio in 1900, by counties.

County.	Loaded at mines for shipment.	Sold to local trade and used by employees.	Used at mines for steam and heat.	Made into coke.	Total production.	Total value.	Average price per ton.	Average number of days active.	Average number of employees.
	Short tons.	*Short tons.*	*Short tons.*	*Short tons.*	*Short tons.*				
Athens	2,198,912	7,570	61,494	15,544	2,283,520	$2,083,222	$0.90	212	3,280
Belmont	1,089,553	195,694	5,505	54,532	1,345,284	1,221,215	.91	207	1,877
Carroll	160,941	3,880	2,700	....	167,521	183,940	1.10	196	366
Columbiana	659,394	19,101	13,769	....	692,264	702,586	1.01	224	1,151
Coshocton	334,633	18,465	216	....	353,314	375,352	1.06	222	607
Guernsey	1,818,025	7,995	26,307	....	1,852,327	1,550,501	.85	230	2,191
Harrison	4,842	1,500	....	....	6,342	6,864	1.08	33	68
Hocking	2,482,018	3,688	32,899	....	2,518,605	2,294,759	.91	241	2,928
Jackson	2,221,411	52,650	30,831	....	2,304,892	2,869,294	1.24	216	4,029
Jefferson	953,460	143,575	12,401	1,150	1,110,586	1,061,918	.96	272	1,415
Lawrence	78,325	17,000	100	....	95,425	92,912	.97	160	273
Mahoning	32,452	12,674	1,336	....	46,462	54,548	1.17	176	142
Medina	113,785	13,493	2,635	....	129,913	186,102	1.43	207	240
Meigs	147,867	92,798	1,610	....	242,275	257,917	1.06	188	542
Morgan	23,954	....	50	....	24,004	27,139	1.13	195	73
Muskingum	145,504	38,636	134	....	184,274	182,176	.99	226	321
Perry	2,313,611	22,440	28,740	....	2,364,791	2,107,487	.90	193	3,184
Stark	1,045,059	37,190	34,275	....	1,116,524	1,702,401	1.52	193	2,232
Summit	105,498	2,401	1,456	....	109,355	156,777	1.43	200	244
Tuscarawas	1,164,940	84,416	11,232	....	1,260,588	1,210,480	.96	212	1,875
Vinton	61,991	6,910	....	....	68,901	69,690	1.01	205	140
Gallia, Noble, Scioto, and Washington	71,341	6,320	1,626	....	79,287	72,064	.91	213	142
Portage, Trumbull, and Wayne	119,956	3,868	7,872	....	131,696	222,902	1.69	214	308
Small mines	....	500,000	....	....	500,000	600,000	......	....	....
Total	17,347,472	1,292,264	277,188	71,226	18,988,150	19,292,246	1.02	215	27,628

Coal production of Ohio in 1901, by counties.

County.	Loaded at mines for shipment.	Sold to local trade and used by employees.	Used at mines for steam and heat.	Made into coke.	Total production.	Total value.	Average price per ton.	Average number of days active.	Average number of employees.
	Short tons.	*Short tons.*	*Short tons.*	*Short tons.*	*Short tons.*				
Athens	2,865,305	14,875	80,540	8,000	2,968,720	$2,649,445	$0.89	198	4,426
Belmont	1,374,608	122,582	9,668	....	1,506,858	1,406,279	.93	195	1,979
Carroll	159,941	17,822	3,010	....	180,773	178,544	.99	232	271
Columbiana	666,119	53,473	15,088	....	734,680	760,736	1.04	200	1,239
Coshocton	379,611	32,848	1,120	....	413,579	444,793	1.08	231	775
Guernsey	2,250,745	7,762	29,363	....	2,287,870	1,904,622	.83	226	2,532
Harrison	75,619	3,856	217	....	79,692	76,835	.96	145	180
Hocking	2,715,974	44,800	7,998	....	2,768,772	2,529,338	.91	234	3,269
Jackson	2,066,492	88,044	20,780	....	2,175,316	2,714,708	1.25	198	4,112
Jefferson	1,154,005	154,232	12,968	1,100	1,322,305	1,286,214	.97	230	1,936
Lawrence	86,004	21,212	....	....	107,216	113,770	1.06	234	312
Mahoning	62,516	45,245	1,588	....	109,349	123,985	1.13	202	219
Medina	88,473	15,604	4,607	....	108,684	154,996	1.43	171	217
Meigs	162,501	73,754	1,359	....	237,614	220,665	.93	163	594
Morgan	27,276	....	....	....	27,276	27,297	1.00	161	48
Muskingum	117,012	20,300	358	....	137,670	129,727	.94	171	259
Perry	2,382,195	20,387	44,290	....	2,446,872	2,206,930	.90	189	3,281
Stark	846,323	36,916	13,757	....	896,996	1,359,636	1.52	126	3,369
Summit	96,184	9,811	993	....	106,988	156,932	1.47	157	318
Tuscarawas	1,427,817	71,497	11,148	....	1,510,462	1,426,242	.94	222	2,198
Vinton	46,177	703	....	....	46,880	50,366	1.07	187	131
Gallia, Noble, Scioto, and Washington	78,404	3,857	250	....	82,511	77,221	.94	162	201
Portage, Trumbull, and Wayne	174,550	6,798	5,376	....	186,724	328,877	1.76	147	245
Small mines	....	500,000	....	....	500,000	600,000	......	....	....
Total	19,303,851	1,366,378	264,478	9,100	20,943,807	20,928,158	1.00	198	32,111

The distribution of the coal product of Ohio since 1889 is shown in the following table:

Distribution of the coal product of Ohio from 1889 to 1901, inclusive.

Year.	Loaded at mines for shipment.	Sold to local trade and used by employees.	Used at mines for steam and heat.	Made into coke.	Total product.	Total value.	Average price per ton.	Average number of days active.	Average number of employees.
	Short tons.	*Short tons.*	*Short tons.*	*Short tons.*	*Short tons.*				
1889	8,566,223	1,196,872	144,223	69,469	9,976,787	$9,355,400	$0.94	....	19,343
1890	10,161,887	1,164,876	143,984	23,759	11,494,506	10,783,171	.94	201	20,576
1891	11,393,209	1,281,568	140,420	53,486	12,868,683	12,106,115	.94	206	22,182
1892	11,995,256	1,411,642	117,486	38,543	13,562,927	12,722,745	.94	212	22,576
1893	11,713,116	1,348,743	167,002	24,785	13,253,646	12,351,139	.92	188	23,931
1894	10,636,402	1,101,940	126,397	45,117	11,909,856	9,841,723	.83	136	27,105
1895	11,933,686	1,227,224	152,277	42,619	13,355,806	10,618,477	.79	176	24,644
1896	11,494,275	1,181,610	172,722	26,595	12,875,202	10,253,461	.79	161	25,500
1897	10,725,047	1,259,290	192,755	19,850	12,196,942	9,535,409	.78	148	26,410
1898	13,053,427	1,226,184	222,913	14,343	14,516,867	12,027,336	.83	169	26,986
1899	14,880,893	1,393,025	211,992	14,360	16,500,270	14,361,903	.87	200	26,038
1900	17,347,472	1,292,264	277,188	71,226	18,988,150	19,292,246	1.02	215	27,628
1901	19,303,851	1,366,378	264,478	9,100	20,943,807	20,928,158	1.00	198	32,111

In connection with the above table it will be observed that the amount of coal mined in the State made into coke in 1901 was only about 12 per cent of that of 1900. The reason for this small report of coal made into coke in 1901 is the fact that most of the coal so used was shipped from a distance to the ovens and was reported as a part of the coal loaded at mines for shipment. The actual amount of coal made into coke in Ohio in 1901 was 162,624 short tons. The production by counties during the last five years and the increases and decreases in 1901 as compared with 1900 are shown in the following table:

Coal production of Ohio since 1897, by counties.

[Short tons.]

County.	1897.	1898.	1899.	1900.	1901.	Increase 1901.	Decrease 1901.	Per cent of increase.	Per cent of decrease.
Athens	1,153,642	1,651,449	1,786,041	2,283,520	2,968,720	685,200	....	30	....
Belmont	827,420	1,036,102	1,242,383	1,345,284	1,506,858	161,574	....	12	....
Carroll	147,931	230,786	227,191	167,521	180,773	13,252	....	7.9	....
Columbiana	774,736	893,680	885,179	692,264	734,680	42,416	....	6.1	....
Coshocton	343,589	367,292	392,373	353,314	413,579	60,265	....	17	....
Gallia	13,802	11,488	13,536	15,620	14,826	....	794	....	5
Guernsey	910,554	1,326,480	1,562,986	1,852,327	2,287,870	435,543	....	23.5	....
Harrison	5,886	29,112	1,390	6,342	79,692	73,350	....	1,156.5	....
Hocking	1,411,907	1,269,786	2,018,865	2,518,605	2,768,772	250,167	....	9.9	....
Jackson	1,562,651	1,770,265	2,032,233	2,304,892	2,175,316	....	129,576	....	5.6
Jefferson	751,848	800,540	924,214	1,110,586	1,322,305	211,719	....	19.0	....
Lawrence	87,340	64,849	116,972	95,425	107,216	11,791	....	1.2	....
Mahoning	37,287	35,785	43,906	46,462	109,349	62,887	....	135.3	....
Medina	170,412	249,406	191,351	129,913	108,684	....	21,229	....	16.3
Meigs	184,197	174,216	273,730	242,275	237,614	....	4,661	....	1.9
Morgan	21,965	26,730	24,905	24,004	27,276	3,272	....	13.6	....
Muskingum	131,606	137,506	142,645	184,274	137,670	....	46,604	....	25.2
Perry	1,595,199	1,831,975	1,735,487	2,364,791	2,446,872	82,081	....	3.4	....
Portage	79,237	82,659	108,008	101,240	150,678	49,438	....	48.8	....
Stark	639,065	888,158	1,079,228	1,116,524	896,996	....	219,528	....	19.6
Summit	52,173	51,722	68,702	109,355	106,988	....	2,367	....	2.1
Trumbull	12,607	1,640	7,575	14,099	8,506	....	5,593	....	39.6
Tuscarawas	626,972	909,857	979,431	1,260,588	1,510,462	249,874	....	19.8	....
Vinton	54,005	81,274	71,839	68,901	46,880	....	22,021	....	31.9
Washington	2,130	2,958	8,322	5,300	3,010	....	2,290	....	43.2
Wayne	61,773	43,356	13,754	16,357	27,540	11,183	....	68.3	....
Noble Scioto	37,008	47,796	[a] 48,024	58,367	64,675	6,308	....	10.8	....
Small mines	500,000	500,000	500,000	500,000	500,000	....	....	....	....
Total	12,196,942	14,516,867	16,500,270	18,988,150	20,943,807	[b] 1,955,657	....	10.3	....

[a] Includes Geauga County.

[b] Net increase.

Although coal has been mined in Ohio for a great many years, the records of production prior to 1872 have not been preserved. Since 1872 the annual production has been as follows:

Annual coal production of Ohio since 1872.

[Short tons.]

Year.	Quantity.	Year.	Quantity.
1872	5,315,294	1887	10,300,708
1873	4,550,028	1888	10,910,951
1874	3,267,585	1889	9,976,787
1875	4,864,259	1890	11,494,506
1876	3,500,000	1891	12,868,683
1877	5,250,000	1892	13,562,927
1878	5,500,000	1893	13,253,646
1879	6,000,000	1894	11,909,856
1880	7,000,000	1895	13,355,806
1881	8,225,000	1896	12,875,202
1882	9,450,000	1897	12,196,942
1883	8,229,429	1898	14,516,867
1884	7,640,062	1899	16,500,270
1885	7,816,179	1900	18,988,150
1886	8,435,211	1901	20,943,807

OREGON.

Total production in 1901, 69,011 short tons; spot value, $173,646.

The principal part of the coal product of Oregon continues to come from the Newport mine, in Coos County. The production in 1901 exceeded that of 1900 by 10,147 short tons, or about 17 per cent, but was still over 17,000 tons short of the production of 1899.

The following tables show the statistics of production in Oregon for the last ten years, and the total output since 1885:

Coal production in Oregon since 1892.

Year.	Loaded at mines for shipment.	Sold to local trade and used by employees.	Used at mines for steam and heat.	Total production.	Total value.	Average number of employees.	Average number of days worked.
	Short tons.	*Short tons.*	*Short tons.*	*Short tons.*			
1892	31,760	2,353	548	34,661	$148,546	90	120
1893	37,835	3,594	254	41,683	164,500	110	192
1894	45,068	2,171	282	47,521	183,914	88	243
1895	68,108	5,294	283	73,685	247,901	414	[a]69
1896	88,116	12,951	654	101,721	294,564	254	191
1897	92,921	5,207	9,161	107,289	291,772	375	200
1898	54,305	3,290	589	58,184	212,184	142	199
1899	78,608	6,656	1,624	86,888	260,917	124	238
1900	48,160	9,590	1,114	58,864	220,001	141	273
1901	53,472	14,531	1,008	69,011	173,646	187	228

[a] The apparently large number of men employed and small average working time are due to the large force of men employed in developing the Beaver Hill mine, which was producing coal for shipment during only twenty days in 1895. The average time made at the Newport mine was over two hundred days per man.

Coal production of Oregon from 1885 to 1901, inclusive.

[Short tons.]

Year.	Quantity.	Year.	Quantity.
1885	50,000	1894	47,521
1886	45,000	1895	73,685
1887	37,696	1896	101,721
1888	75,000	1897	107,289
1889	64,359	1898	58,184
1890	61,514	1899	86,888
1891	51,826	1900	58,864
1892	34,661	1901	69,011
1893	41,683		

PENNSYLVANIA.

Total production in 1901, 133,730,011 long tons, or 149,777,613 short tons; spot value, $193,901,606.

Anthracite: Total production, 60,242,560 long tons, or 67,471,667 short tons; spot value, $112,504,020.

Bituminous: Total production, 73,487,451 long tons, or 82,259,591 short tons; spot value, $81,397,586.

The combined production of anthracite and bituminous coal in Pennsylvania in 1900 was 122,509,144 long tons, equivalent to 137,210,241 short tons, compared with which the production in 1901 shows an increase of 11,220,867 long tons, or 12,567,372 short tons. The total value of the product in 1900 was $163,196,396, compared with which the value of the product in 1901 shows an increase of $30,705,210. The percentage of increase in production is 9.1; the percentage of increase in the value is 18.8.

During 1900 the anthracite production in Pennsylvania was considerably lessened because of the notable strike in that year, which tied up practically the entire region from September 17 until October 27. While the strike was in progress the production in the anthracite region practically ceased, and by it a prospective output of about 5,000,000 tons was eliminated. There was, however, during the rest of the year an unusual activity throughout the anthracite region, and during the period the mines were running the production increased, as compared with the corresponding period in the preceding year, about 2,300,000 long tons. The net loss in the anthracite production during the year, as compared with 1899, was 2,723,294 long tons, or 3,050,090 short tons, and $2,384,279 in value. In 1901 the anthracite region was almost entirely free from labor disturbances of any nature, as a result of which the production increased, as compared with the lessened output in 1900, 9,011,207 long tons, or 17.6 per cent. This is the largest increase ever recorded in any one year for the anthracite coal region. As compared with 1899, however, the output last year showed a gain of only 6,297,913 long tons, or 12 per cent.

The bituminous production of Pennsylvania in 1901 increased only 2,463,620 short tons, or 3 per cent in amount, and $3,959,041, or 5 per cent in value. In 1900 the production of bituminous coal increased 5,692,151 short tons, or 7.7 per cent in amount, and $21,190,754, or 37.4 per cent in value.

Considering only the marketable sizes, the average price of the anthracite coal in Pennsylvania in 1901 was $2.05 per long ton, as compared with $1.85 in 1900 and $1.80 in 1899. The average price per ton for bituminous coal in 1901 was $0.99, as compared with $0.97 in 1900 and $0.76 in 1899. The price for anthracite coal in Pennsylvania in 1901 was the highest since 1888. The price for Pennsylvania bituminous coal was the highest since 1886.

During the last twenty years the conditions affecting the anthracite coal mining industry have materially changed. The change has been a gradual but a very decided one. It has been a practical elimination of anthracite coal as a factor in manufacturing, and its restriction now almost entirely to domestic consumption, and even as a domestic fuel it has not kept pace with the increased use of bituminous coal.

The construction of large office buildings and apartment houses has substituted steam and hot-water heat generated by bituminous coal for individual offices and dwellings formerly heated by anthracite-burning stoves or furnaces, while the use of coke and gas—themselves the products of bituminous coal—has been entering more and more into domestic consumption, particularly for cooking purposes, in the place of anthracite.

The following statement will show to what an extent anthracite has failed to keep abreast of our industrial development: In 1880 the production of anthracite coal was 25,580,189 long tons; the bituminous output in the same year was 38,242,641 long tons, or 50 per cent more than that of anthracite. In 1885 the production of anthracite coal had grown to 34,228,548 long tons; that of bituminous to 64,840,668 long tons, or 89 per cent more than the anthracite production. In 1890 the anthracite output was 41,489,858 long tons; the bituminous product was 99,377,073 long tons. In this year the production of bituminous coal was 140 per cent more than that of anthracite. In the next five years—to 1895—the anthracite production had increased to 51,785,122 long tons, and the bituminous to 120,641,244 long tons, or 133 per cent more than anthracite. This was a year of excessive anthracite production, in which the output was much greater than the demand, and was sold at prices considerably below its actual worth. In 1900 the anthracite production was 51,221,353 long tons, while the bituminous production amounted to 189,784,564 long tons, or 270 per cent larger than the anthracite. From this it will be seen that, whereas in 1880 the bituminous product was only 1.5 times as much as anthracite, in 1900 it was 3.7 times. The anthracite production in 1901 was increased because of the shortage made by the strike of the year before, and because of the general condition of prosperity which prevailed throughout the United States, and particularly in the Eastern cities, where anthracite coal finds its principal markets. The production last year was not quite 2.4 times that of 1880. The bituminous product last year was about 5.3 times that of 1880, so that the ratio of increase between the production in 1901 and 1880 is more than two to one in favor of bituminous coal.

The anthracite region was practically free from any labor disturbances during 1901, in sharp contrast to the conditions which obtained in 1900, and those existing at the time of writing this report [June, 1902]. At the writing of this report, operations in the anthracite region are entirely suspended as a result of a strike ordered by the United Mine Workers in order to enforce their demands. The strike was promulgated at a convention held in Hazleton, Pa., on May 8, and was the result of the refusal of the operators to accede to demands made at a previous convention held at Shamokin the latter part of March. Originally these demands were in brief as follows:

1. To enforce an eight-hour working day with same daily wage as at present.
2. Recognition of mine committees for the adjustment of disputes.
3. Arbitration of labor disputes.
4. Abolition of contract system now in force at some collieries, and the limitation to two of the number of laborers who may be employed by any one contractor.

At the Hazelton convention these demands were modified and were presented in the following form, and because of their refusal the strike was declared:

1. An eight-hour day for all men on company account.
2. Coal mined to be weighed and the miner paid by weight instead of by the car, 2,240 pounds making a ton.
3. Recognition of the union.

Other resolutions not bearing directly on the questions of wages or recognition of the union were also passed. The large producing companies were not represented at the convention, though invited to be present, and as the demands were not acceded to in any way, suspension of work was ordered for and became effective on Monday, May 12.

As a result of this strike, approximately 140,000 men are idle, and also as a result the production for the current year will show a decided decrease as compared with 1901. As the entire supply of anthracite coal has been shut off from a large number of markets, bituminous coal, or its products, coke and gas, have obtained a foothold which in many cases will not be lost. In some cases, too, manufacturers have considered the feasibility of installing oil-burning devices, and it is quite probable that this new fuel will become a strong competitor of anthracite coal for manufacturing purposes in cities where smoke-suppressing ordinances are enforced.

The combined production of anthracite and bituminous coal in Pennsylvania has always exceeded one-half the total production of the United States, and amounts to over 15 per cent of the entire world's production. The coal production of Pennsylvania alone exceeds that of any country of the Old World, except Great Britain and Germany. It exceeds the production of Austria, France, and Belgium combined, and the production in 1901 was only 10 per cent less than that of Germany in 1900. In 1880 Pennsylvania produced 65 per cent, or practically two-thirds of the total output of the United States, and has averaged about 55 per cent in the last 22 years. The percentage of Pennsylvania's production of the total in 1900 and 1901 was 51, the lowest in this entire period. The increased production in the Southern and Western States is responsible for the smaller percentage of Pennsylvania.

In the following table is shown the total production of Pennsylvania and of the United States since 1880, with the percentage of the total produced by Pennsylvania in each year:

Production of Pennsylvania coal compared with total United States since 1880.

Year.	Total United States.	Pennsylvania.	Per cent of Pennsylvania to total.
	Short tons.	*Short tons.*	
1880	71,481,569	47,529,711	65
1881	85,881,030	54,320,018	63
1882	103,285,789	57,254,507	55
1883	115,212,125	62,488,190	54
1884	119,735,051	62,404,488	52
1885	110,957,522	62,137,271	56
1886	112,743,403	62,857,210	56
1887	129,975,557	70,372,857	54
1888	148,659,402	77,719,624	52
1889	141,229,514	81,719,059	58
1890	157,788,657	88,770,814	56
1891	168,566,668	93,453,921	55
1892	179,329,071	99,167,080	55
1893	182,352,774	98,038,267	54
1894	170,741,526	91,833,584	54
1895	193,117,530	108,216,565	56
1896	191,986,357	103,903,534	54
1897	200,221,665	107,029,654	53
1898	219,974,667	118,547,777	54
1899	253,739,992	134,568,180	53
1900	269,881,827	137,210,241	51
1901	293,298,516	149,777,613	51

The production of anthracite and bituminous coal in Pennsylvania is discussed separately in the following pages. The chapter on anthracite production has been prepared for this report, as heretofore, by Mr.

William W. Ruley, of Philadelphia, the Chief of the Bureau of Anthracite Coal Statistics. Mr. Ruley is thoroughly familiar with all the conditions affecting the anthracite industry. One of the features of his report for this year is the discussion as to the proportion of the various sizes of coal shipped to market and the changes which have taken place in recent years in this regard.

PENNSYLVANIA ANTHRACITE.

By William W. Ruley.

The year 1901 was noteworthy in the anthracite trade for two reasons: First, the largest production in the history of the trade; second, the largest average net return realized during the last ten years. These results were brought about by the remarkable demand for this fuel, which was at nearly all times during the year in excess of the supply.

At the commencement of the year stocks were nearly exhausted at all points, the cause being the long strike in the latter part of 1900, during which all stocks of coal were used up. The total production amounted to 60,242,560 tons, an increase over the year 1900 of 9,021,207 tons, and made up as follows:

	Long tons.
Sent to market	53, 694, 530
Sold to local trade and used by employees at mines	1, 185, 480
Used for steam and heat at mines	5, 362, 550
Total	60, 242, 560

The item "Used for steam and heat at the mines" consists mostly of culm and dirt, and its value is not taken into consideration in making up the average prices per ton at the mines and the total value of product.

This value in 1901 was $112,504,020, an average price of $2.05 per ton at the mines, being an increase of 25 cents over that of the year 1900. The following table will show the total production, total value, average price per ton, number of employees, and days worked for the last five years:

Production of anthracite coal from 1897 to 1901, inclusive.

Year.	Production.	Value.	Average per ton.	Number of employees.	Days worked
	Long tons.				
1897	46, 974, 715	$79, 301, 954	$1.85	149, 557	150
1898	47, 663, 076	75, 414, 537	1.75	145, 184	152
1899	53, 944, 647	88, 142, 130	1.80	139, 608	173
1900	51, 221, 353	85, 757, 851	1.85	144, 206	166
1901	60, 242, 560	112, 504, 020	2.05	145, 309	196

In the two following tables the production is shown divided according to counties for the years 1900 and 1901, and from them can be seen the variation in production in the several counties as well as the increase in the total production, that shipped to market, sold to local trade, and used for steam and heat at the mines.

Anthracite coal production in 1900, by counties:

[Long tons.]

	Total production.	Shipments.	Local trade.	Used at mines.
Susquehanna	496,432	464,431	9,724	22,277
Lackawanna	12,652,902	11,547,926	276,342	828,634
Luzerne	18,964,491	16,721,735	458,576	1,784,180
Carbon	1,843,886	1,610,738	34,226	198,922
Schuylkill	11,436,981	9,898,949	186,572	1,351,460
Columbia	875,643	794,839	10,953	69,851
Sullivan	175,938	169,138	1,351	5,449
Northumberland	4,180,426	3,639,291	80,879	460,256
Dauphin	594,654	429,575	20,350	144,729
Total	51,221,353	45,276,622	1,078,973	4,865,758

Anthracite coal production in 1901, by counties.

[Long tons.]

	Total production.	Shipments.	Local trade.	Used at mines.
Susquehanna	663,486	623,614	9,870	30,002
Lackawanna	15,874,320	14,584,747	301,731	987,842
Luzerne	21,345,737	18,997,180	520,486	1,828,071
Carbon	1,774,258	1,525,896	27,638	220,724
Schuylkill	13,678,641	11,900,379	185,809	1,592,453
Columbia	1,082,613	994,316	14,366	73,931
Sullivan	134,459	125,929	3,790	4,740
Northumberland	4,947,465	4,373,070	99,926	474,469
Dauphin	741,581	569,399	21,864	150,318
Total	60,242,560	53,694,530	1,185,480	5,362,550

In order to continue the record of anthracite business from the earliest date to the present time the following table shows the shipments of coal from each region from 1820 to 1901, inclusive. It should be noted that these shipments include only coal loaded on cars for line or tide-water points, and do not include any coal sold locally or used under the boilers at the mines.

Annual shipments from the Schuylkill, Lehigh, and Wyoming regions from 1820 to 1901, inclusive.

Year.	Schuylkill region.		Lehigh region.		Wyoming region.		Total.
	Quantity.	Per cent.	Quantity.	Per cent.	Quantity.	Per cent.	Quantity.
	Long tons.		*Long tons.*		*Long tons.*		*Long tons.*
1820	....	....	365	....	....	....	365
1821	....	....	1,073	....	....	....	1,073
1822	1,480	39.79	2,240	60.21	....	....	3,720
1823	1,128	16.23	5,823	83.77	....	....	6,951
1824	1,567	14.10	9,541	85.90	....	....	11,108
1825	6,500	18.60	28,393	81.40	....	....	34,893
1826	16,767	34.90	31,280	65.10	....	....	48,047
1827	31,360	49.44	32,074	50.56	....	....	63,434
1828	47,284	61.00	30,232	39.00	....	....	77,516
1829	79,973	71.35	25,110	22.40	7,000	6.25	112,083
1830	89,984	51.50	41,750	23.90	43,000	24.60	174,734
1831	81,854	46.29	40,966	23.17	54,000	30.54	176,820
1832	209,271	57.61	70,000	19.27	84,000	23.12	363,271
1833	252,971	51.87	123,001	25.22	111,777	22.91	487,749
1834	226,692	60.19	106,244	28.21	43,700	11.60	376,636
1835	339,508	60.54	131,250	23.41	90,000	16.05	560,758
1836	432,045	63.16	148,211	21.66	103,861	15.18	684,117
1837	530,152	60.98	223,902	25.75	115,387	13.27	869,441
1838	446,875	60.49	213,615	28.92	78,207	10.59	738,697
1839	475,077	58.05	221,025	27.01	122,300	14.94	818,402
1840	490,596	56.75	225,313	26.07	148,470	17.18	864,379
1841	624,466	65.07	143,037	14.90	192,270	20.03	959,773
1842	583,273	52.62	272,540	24.59	252,599	22.79	1,108,412
1843	710,200	56.21	267,793	21.19	285,605	22.60	1,263,598
1844	887,937	54.45	377,002	23.12	365,911	22.43	1,630,850
1845	1,131,724	56.22	429,453	21.33	451,836	22.45	2,013,013
1846	1,308,500	55.82	517,116	22.07	518,389	22.11	2 344,005
1847	1,665,735	57.79	633,507	21.98	583,067	20.23	2,882,309
1848	1,733,721	56.12	670,321	21.70	685,196	22.18	3,089,238
1849	1,728,500	53.30	781,556	24.10	732,910	22.60	3,242,966
1850	1,840,620	54.80	690,456	20.56	827,823	24.64	3,358,899
1851	2,328,525	52.34	964,224	21.68	1,156,167	25.98	4,448,916
1852	2,636,835	52.81	1,072,136	21.47	1,284,500	25.72	4,993,471
1853	2,665,110	51.30	1,054,309	20.29	1,475,732	28.41	5,195,151
1854	3,191,670	53.14	1,207,186	20.13	1,603,478	26.73	6,002,334
1855	3,552,943	53.77	1,284,113	19.43	1,771,511	26.80	6,608,567
1856	3,603,029	52.91	1,351,970	19.52	1,972,581	28.47	6,927,580
1857	3,373,797	50.77	1,318,541	19.84	1,952,603	29.39	6,644,941
1858	3,273,245	47.86	1,380,030	20.18	2,186,094	31.96	6,839,369
1859	3,448,708	44.16	1,628,311	20.86	2,731,236	34.98	7,808,255
1860	3,749,632	44.04	1,821,674	21.40	2,941,817	34.56	8,513,123
1861	3,160,747	39.74	1,738,377	21.85	3,055,140	38.41	7,954,264
1862	3,372,583	42.86	1,351,054	17.17	3,145,770	39.97	7,869,407
1863	3,911,683	40.90	1,894,713	19.80	3,759,610	39.30	9,566,006
1864	4,161,970	40.89	2,054,669	20.19	3,960,836	38.92	10,177,475
1865	4,356,959	45.14	2,040,913	21.14	3,254,519	33.72	9,652 391
1866	5,787,902	45.56	2,179,364	17.15	4,736,616	37.29	12,703,882
1867	5,161,671	39.74	2,502,054	19.27	5,325,000	40.99	12,988,725
1868	5,330,737	38.52	2,502,582	18.13	5,968,146	43.25	13,801,465
1869	5,775,138	41.66	1,949,673	14.06	6,141,369	44.28	13,866,180
1870	4,968,157	30.70	3,239,374	20.02	7,974,690	49.28	16,182,191
1871	6,552,772	41.74	2,235,707	14.24	6,911,242	44.02	15,699,721

Annual shipments from the Schuylkill, Lehigh, and Wyoming regions, etc.—Continued.

Year.	Schuylkill region.		Lehigh region.		Wyoming region.		Total.
	Quantity.	Per cent.	Quantity.	Per cent.	Quantity.	Per cent.	Quantity.
	Long tons.		*Long tons.*		*Long tons.*		*Long tons.*
1872	6,694,890	34.03	3,873,339	19.70	9,101,549	46.27	19,669,778
1873	7,212,601	33.97	3,705,596	17.46	10,309,755	48.57	21,227,952
1874	6,866,877	34.09	3,773,836	18.73	9,504,408	47.18	20,145,121
1875	6,281,712	31.87	2,834,605	14.38	10,596,155	53.75	19,712,472
1876	6,221,934	33.63	3,854,919	20.84	8,424,158	45.53	18,501,011
1877	8,195,042	39.35	4,332,760	20.80	8,300,377	39.85	20,828,179
1878	6,282,226	35.68	3,237,449	18.40	8,085,587	45.92	17,605,262
1879	8,960,829	34.28	4,595,567	17.58	12,586,293	48.14	26,142,689
1880	7,554,742	32.23	4,463,221	19.05	11,419,279	48.72	23,437,242
1881	9,253,958	32.46	5,294,676	18.58	13,951,383	48.96	28,500,017
1882	9,459,288	32.48	5,689,437	19.54	13,971,371	47.98	29,120,096
1883	10,074,726	31.69	6,113,809	19.23	15,604,492	49.08	31,793,027
1884	9,478,314	30.85	5,562,226	18.11	[a] 15,677,753	51.04	30,718,293
1885	9,488,426	30.01	5,898,634	18.65	[a] 16,236,470	51.34	31,623,530
1886	9,381,407	29.19	5,723,129	17.89	[a] 17,031,826	52.82	32,136,362
1887	10,609,028	30.63	4,347,061	12.55	[a] 19,684,929	56.82	34,641,018
1888	10,654,116	27.93	5,639,236	14.78	[a] 21,852,366	57.29	38,145,718
1889	10,486,185	29.28	6,294,073	17.57	[a] 19,036,835	53.15	35,817,093
1890	10,867,822	29.68	6,329,658	17.28	[a] 19,417,979	53.04	36,615,459
1891	12,741,258	31.50	6,381,838	15.78	21,325,240	52.72	40,448,336
1892	12,626,784	30.14	6,451,076	15.40	22,815,480	54.46	41,893,340
1893	12,357,444	28.68	6,892,352	15.99	23,839,741	55.33	43,089,537
1894	12,035,005	29.08	6,705,434	16.20	22,650,761	54.72	41,391,200
1895	14,269,932	30.68	7,298,124	15.69	24,943,421	56.63	46,511,477
1896	13,097,571	30.34	6,490,441	15.03	23,589,473	54.63	43,177,485
1897	12,181,061	29.26	6,249,540	15.00	23,207,263	55.74	41,637,864
1898	12,078,875	28.83	6,253,109	14.92	23,567,767	56.25	41,899,751
1899	14,199,009	29.79	6,887,909	14.45	26,578,286	55.76	47,665,204
1900	13,502,732	29.94	6,918,627	15.33	24,686,125	54.73	45,107,484
1901	16,019,591	29.92	7,211,974	13.45	30,337,036	56.63	53,568,601
Total	409,472,958	33.41	208,568,818	17.02	607,539,493	49.57	1,225,581,269

[a] Includes Loyalsock field.

In the report for 1900 comment was made on the proportion of the various sizes of coal shipped to market and attention was called to the fact that the prepared sizes, broken, egg, stove, and chestnut, made up, in 1875, about 75 per cent of the total product shipped, pea about 6½ per cent, and sizes below pea little or nothing. In 1900 the prepared sizes made up only 60 per cent of the total shipments, while pea coal had increased to 14 per cent, and sizes smaller than pea to 21 per cent. The larger part of this increase in small sizes was made up of coal washed from the culm banks by plants known as washeries. In 1901 the proportion of sizes shipped varied only slightly from the previous year; prepared sizes being about 60 per cent of the total shipments, pea about 14 per cent, and sizes smaller than pea about 21½ per cent, the remainder being lump coal.

The above territory is reached by 11 so-called initial railroads, as follows:

Philadelphia and Reading Railway Company.
Lehigh Valley Railroad Company.
Central Railroad of New Jersey.[a]
Delaware, Lackawanna and Western Railroad Company.
Delaware and Hudson Company's Railroad.
Pennsylvania Railroad Company.
Erie and Wyoming Valley Railroad Company.[b]
Erie Railroad Company.
New York, Ontario and Western Railroad Company.
Delaware, Susquehanna and Schuylkill Railroad Company.
New York, Susquehanna and Western Railroad Company.[b]

PENNSYLVANIA BITUMINOUS COAL.

The total production in 1901 was 82,305,946 short tons; spot value, $81,397,586.

In the report for 1900 it was stated that the most notable feature in connection with the production of coal in Pennsylvania for that year was the increase in value, which showed a gain over 1899 of $21,190,754, or 37.7 per cent, the amount of coal produced having increased only 5,692,151 short tons, or 7.7 per cent.

The average price per ton obtained for bituminous coal in Pennsylvania in 1900 was 97 cents, as compared with 76 cents in 1899, and recorded the highest figure reached in fifteen years. The advanced price reached in 1900 was not only maintained in 1901, but was slightly increased, the average price for the State being 99 cents. The years 1899, 1900, and 1901 record the only instances since 1892 in which the price of bituminous coal has advanced. Comparing the statistics of 1901 with those of the preceding year, it is found that the production increased 2,463,620 short tons, or 3 per cent, and that the value increased $3,959,041, or a little over 5 per cent.

Of the total production in 1901, 29,591,368 tons, or 35.86 per cent, were produced by the use of mining machines. The number of mining machines in use in the State increased from 1,343 in 1899 to 1,788 in 1900, and to 2,058 in 1901. The statistics for 1900 show that there were 73 firms or corporations in the State using machines, as against 103 in 1899. This apparent decrease in the number of establishments was due to the formation of the Monongahela River Consolidated Coal and Coke Company, having control of the majority of the river mines in the Pittsburg district, and the Pittsburg Coal Company, formed by the consolidation of most of the rail-shipping mines in the vicinity of Pittsburg. Of the machines in use in 1901, 1,409 were pick machines, 645 were chain machines, 3 undercutting or shearing machines, and 1 was a long-wall machine.

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[a] Controlled by Philadelphia and Reading Railway Company.
[b] Controlled by Erie Railroad.

The number of men on strike in the bituminous district of Pennsylvania last year was 2,541, and the average time lost per man was 49 days, or a total loss of 125,116 working days. This compares with 7,574 men idle for an average of 29 days per man in 1900, entailing a total loss of 223,093 working days.

The counties of Fayette and Westmoreland, in which is included the Connellsville coking region, continue at the head of the coal-producing counties of Pennsylvania. These two counties in 1901 contributed over 31,350,000 short tons, or 38 per cent of the total bituminous product of the State. Fayette County continued in first place, having an output in 1901 of a little over 1,000,000 tons in excess of that of Westmoreland County. Allegheny County, which includes a large proportion of the Pittsburg district, is third in importance, with a production in 1901 of 10,307,100 short tons. Cambria County, which includes the iron and steel industries in the vicinity of Johnstown, is fourth in importance, and was credited with a production in 1901 of 9,045,201 short tons. Following these, among the more important coal-producing counties are Washington County, with a production in 1901 of 5,910,621 short tons; Clearfield County, with 5,886,407 short tons; Jefferson County, with 5,806,568 short tons, and Somerset County, with 4,831,660 short tons. All of these counties, with the exception of Clearfield and Jefferson, increased their production in 1901 as compared with 1900. The largest increase was in Fayette County, which is credited with a gain of 1,131,982 short tons. Washington County increased its production 1,054,483 short tons, and Cambria County is credited with a gain of 844,835 short tons.

Of the 31,352,524 tons of coal produced in Fayette and Westmoreland counties, 17,244,640 tons were made into coke at the mines. The total amount of coal made into coke at the mines in 1901 was 19,120,251 short tons, as compared with 18,571,506 short tons in 1900. Including the amount of coal shipped to distant points and there made into coke last year, the total quantity coked amounted to 21,726,467 short tons.

The statistics of production, by counties, in the last two years, with the distribution of the product for consumption, are shown in the following tables:

Bituminous coal production of Pennsylvania in 1900, by counties.

County.	Loaded at mines for shipment.	Sold to local trade and used by employees.	Used at mines for steam and heat.	Made into coke.	Total production.	Total value.	Average price per ton.	Average number of days active.	Average number of employees.
	Short tons.	*Short tons.*	*Short tons.*	*Short tons.*	*Short tons.*				
Allegheny	9,712,280	234,620	105,005	....	10,051,905	$10,183,414	$1.01	220	14,127
Armstrong	1,239,128	58,747	15,313	....	1,313,188	1,177,681	.90	268	2,000
Beaver	246,270	14,021	2,107	....	262,398	305,424	1.16	241	421
Bedford	395,323	4,974	5,997	163,761	570,055	565,944	.99	206	1,002
Blair	381,913	2,248	4,743	108,088	496,992	522,856	1.05	231	773
Butler	204,425	16,534	745	....	221,704	203,110	.91	220	410
Cambria	7,562,722	130,068	84,639	412,937	8,190,366	8,300,949	1.01	246	10.634
Center	928,366	2,305	1,594	....	932,265	814,801	.87	212	1,314
Clarion	399,712	933	3,994	....	404,639	357,750	.88	234	706
Clearfield	6,194,459	51,440	70,574	304,361	6,620,834	5,846,367	.88	232	8,994
Elk	884,549	25,244	14,029	2,581	926,403	752,140	.81	222	1,375
Fayette	5.247,981	118,263	267,499	9,421,499	15,055,242	14,284,688	.95	251	12,111
Huntingdon	359,539	2,708	6,695	....	368,942	389,941	1.06	243	599
Indiana	825,314	4,002	4,529	90,937	924,782	894,157	.97	237	1,354
Jefferson	5,022,691	26,790	116,024	1,033,785	6,199,290	4,616,225	.74	249	5,913
Lawrence	181,677	5,413	720	....	187,810	216,267	1.15	261	459
Mercer	505,693	5,385	16,992	....	528,070	513,467	.97	227	837
Somerset	4,685,574	11,755	49,430	32,548	4,779,307	4,877,466	1.02	260	5,369
Tioga	909,503	15,952	5,846	....	931,301	1,195,046	1.28	247	1,975
Washington	4,781,072	20,948	54,118	....	4,856,138	4,721,424	.97	217	6,109
Westmoreland	7,596,390	148,241	234,895	7,001,009	14,980,535	15,645,834	1.04	262	15,648
Bradford Clinton	318,819	273	1,854	....	320,946	303,747	.95	296	322
Lycoming McKean	112,700	5,914	600	....	119,214	149,847	1.26	242	240
Small mines	....	600,000	....	....	600,000	600,000	......	....	....
Total	58,696,100	1,506,778	1,067,942	18,571,506	79,842,326	77,438,545	.97	242	92,692

Bituminous coal production of Pennsylvania in 1901, by counties.

County.	Loaded at mines for shipment.	Sold to local trade and used by employees.	Used at mines for steam and heat.	Made into coke.	Total production.	Total value.	Average price per ton.	Average number of days active.	Average number of employees.
	Short tons.	*Short tons.*	*Short tons.*	*Short tons.*	*Short tons.*				
Allegheny	9,758,070	439,172	109,858	....	10,307,100	$10,294,035	$1.00	243	12,389
Armstrong	1,511,355	29,794	14,106	....	1,555,255	1,433,513	.92	255	2,342
Beaver	163,683	9,405	2,924	....	176,012	185,923	1.06	145	429
Bedford	447,779	4,413	6,540	41,590	500,322	500,990	1.00	228	939
Blair	318,389	1,302	5,063	44,025	368,779	388,768	1.05	203	549
Butler	263,441	4,074	1,646	....	269,161	245,174	.91	230	526
Cambria	8,301,413	96,334	145,672	501,782	9,045,201	9,181,837	1.02	219	13,929
Center	835,079	2,656	1,777	....	839,512	774,751	.92	197	1,205
Clarion	348,902	2,156	3,782	....	354,840	327,999	.92	191	748
Clearfield	5,679,850	34,081	84,240	88,236	5,886,407	5,377,127	.91	206	8,760
Elk	972,925	17,115	17,274	....	1,007,314	957,137	.95	223	1,711
Fayette	4,826,113	162,680	300,310	10,898,121	16,187,224	16,243,131	1.00	254	14,559
Huntingdon	361,964	3,704	8,861	....	374,529	395,376	1.05	216	706
Indiana	929,587	4,356	11,212	129,105	1,074,260	997,012	.93	213	1,851
Jefferson	4,612,722	19,398	147,704	1,026,744	5,806,568	4,909,817	.85	259	6,914
Lawrence	163,477	4,700	3,782	....	171,959	145,948	.85	270	404
Mercer	549,434	6,820	21,084	....	577,338	501,609	.87	204	1,007
Somerset	4,689,377	29,420	68,734	44,129	4,831,660	5,245,113	1.09	212	6,222
Tioga	833,736	20,508	6,828	....	861,072	1,124,828	1.31	192	2,274
Washington	5,807,698	26,939	75,984	....	5,910,621	5,751,934	.97	210	7,290
Westmoreland	8,357,216	160,876	300,689	6,346,519	15,165,300	15,321,983	1.01	238	16,532
Bradford	327,787	404	226	....	328,417	353,287	1.08	314	393
Clinton									
Lycoming	105,320	975	800	....	107,095	140,294	1.31	257	225
McKean									
Small mines	....	600,000	....	....	600,000	600,000	......	....	....
Total	60,165,317	1,681,282	1,339,096	19,120,251	82,305,946	81,397,586	.99	230	101,904

In the following table is exhibited the total production in the last five years, and the increases and decreases in 1901 as compared with 1900:

Bituminous coal production of Pennsylvania since 1897, by counties.

[Short tons.]

County.	1897.	1898.	1899.	1900.	1901.	Increase, 1901.	Decrease, 1901.	Per cent of increase.	Per cent of decrease.
Allegheny	7,216,039	8,889,997	9,972,060	10,051,905	10,307,100	255,195	....	2.5	....
Armstrong	857,637	818,404	1,054,389	1,313.188	1,555,255	242,067	....	18.4	....
Beaver	99,546	223,855	258,466	262,398	176,012	....	86,386	....	32.9
Bedford	436,619	456,507	493,965	570,055	500,322	....	69,733	....	12.2
Blair	492,975	404,043	407,356	496,992	368,779	....	128,213	....	25.7
Bradford	41,588	22,508	31,835	32,065	22.189	....	9,876	....	30.7
Butler	233,689	161,312	214,899	221,704	269.161	47,457	....	21.4	....
Cambria	5,416,950	6,740,461	7,208,834	8,190,366	9,045,201	854,835	....	10.4	....
Center	521,100	714,175	912,648	932,265	839,512	....	92,753	....	9.9
Clarion	247,839	278.131	289,753	404,639	354,840	....	49,799	....	12.3
Clearfield	5,479,047	6,055,739	6,251,442	6,620,834	5,886,407	....	734,427	....	11.0
Clinton	157,333	166,250	221,574	288,881	306,228	17,347	....	6.0	....
Elk	969,503	873,485	1,221,979	926,403	1,007,314	80,911	....	8.7	....
Fayette	9,701,691	12,696,063	14,609,289	15,055,242	16,187,224	1,131,982	....	7.5	....
Huntingdon	303,939	312,607	357,812	368,942	374,529	5,587	....	1.2	....
Indiana	541,967	563,791	616,911	924,782	1,074,260	149,478	....	16.1	....
Jefferson	4,697,059	5,625,168	5,841,960	6,199,290	5,806,568	....	392,722	....	6.3
Lawrence	195,286	185,408	183,555	187,810	171,959	....	15,851	....	8.4
Lycoming	91,735	98,118	101,923	99,000	107,095	8,095	....	8.1	....
McKean	31,527	25,622	23,703	20,214	....	....	20,214	....	100.0
Mercer	435,772	316,669	486,724	528,070	577,338	49,268	....	9.3	....
Somerset	924,607	1,846,398	2,950,343	4,779,307	4,831,660	52,353	....	1.0	....
Tioga	938,053	921,760	670,126	931,301	861,072	....	70,229	....	7.5
Washington	3,862,661	4,753,673	4,987,360	4,856,138	5,910,621	1,054,483	....	21.7	....
Westmoreland	9,923,812	11,414,989	14,181,269	14,980,535	15,165.300	184,765	....	1.2	....
Small mines	600,000	600,000	600,000	600,000	600,000	....	....	....	....
Total	54,417,974	65,165,133	74,150,175	79,842,326	82,305.946	4,133,823	1,670,203	....	....
Net increase	4,860,521	10,747,159	8,985,042	5,692,151	2,463,620	2,463,620	....	3.0	....

The distribution of the product for consumption during the last thirteen years has been as follows:

Distribution of the bituminous coal product of Pennsylvania from 1889 to 1901.

Year.	Loaded at mines for shipment.	Sold to local trade and used by employees.	Used at mines for steam and heat.	Made into coke.	Total product.	Total value.	Average price per ton.	Average number of days active.	Average number of employees.
	Short tons.	*Short tons.*	*Short tons.*	*Short tons.*	*Short tons.*				
1889	24,059,913	1,590,651	332,937	10,190,588	36,174,089	$27,953,315	$0.77	....	53,780
1890	29,288,923	1,473,317	395,837	11,144,096	42,302,173	35,376,916	.84	232	61,333
1891	29,976,914	2,007,348	321,225	10,483,003	42,788,490	37,271,053	.87	223	63,661
1892	32,425,949	2,207,827	356,779	11,704,021	46,694,576	39,017,164	.84	223	66,655
1893	33,322,328	1,934,429	426,122	8,387,845	44,070,724	35,260,674	.80	190	71,931
1894	29,722,803	1,589,595	342,294	8,257,771	39,912,463	29,479,820	.74	165	75,010
1895	35,164,453	1,732,803	468,381	12,851,591	50,217,228	35,980,357	.72	206	71,130
1896	37,696,555	1,570,161	504,224	9,786,513	49,557,453	35,368,249	.71	206	72,625
1897	40,419,846	1,653,049	556,604	11,968,392	54,597,891	37,636,347	.69	205	77,599
1898	48,019,561	1,520,750	732,984	14,891,838	65,165,133	43,352,588	.67	229	79,611
1899	53,671,963	1,525,772	972,692	17,979,748	74,150,175	56,247,791	.76	245	82,812
1900	58,696,100	1,506,778	1,067,942	18,571,506	79,842,326	77,438,545	.97	242	92,692
1901	60,165,317	1,681,282	1,339,096	19,120,251	82,305,946	81,397,586	.99	230	101,904

The following table exhibits the total production since 1873:

Production of bituminous coal in Pennsylvania since 1873.

[Short tons.]

Year.	Quantity.	Year.	Quantity.
1873	13,098,829	1888	33,796,727
1874	12,320,000	1889	36,174,089
1875	11,760,000	1890	42,302,173
1876	12,880,000	1891	42,788,490
1877	14,000,000	1892	46,694,576
1878	15,120,000	1893	44,070,724
1879	16,240,000	1894	39,912,463
1880	21,280,000	1895	50,217,228
1881	22,400,000	1896	49,557,453
1882	24,640,000	1897	54,417,974
1883	26,880,000	1898	65,165,133
1884	28,000,000	1899	74,150,175
1885	26,000,000	1900	79,842,326
1886	27,094,501	1901	82,305,946
1887	31,516,856		

TENNESSEE.

Total production in 1901, 3,633,290 short tons; spot value, $4,067,389.

As compared with 1900 the coal production of Tennessee in 1901 presents an increase of 123,728 short tons, or 3.5 per cent. This makes an unbroken record since 1893 in which the coal output of Tennessee has increased, as compared with the preceding year, and is the maximum product ever attained, being nearly double that of 1893. The value of the product in 1901 was $4,067,389, as compared with $4,003,082 in 1900, an increase of $64,307. The average price per ton declined from $1.14 in 1900 to $1.12 in 1901.

The statistics in regard to the production of coal by machinery show that in 1901 the total number of machines in use was 21, and the total machine-mined product amounted to 220,573 short tons, equivalent to 6.06 per cent of the total production. In 1900 the machine-mined product amounted to 176,872 short tons, or 4.77 per cent of the total. In this year there were 3 mines using machines, and 18 machines in use.

The labor disturbances in 1901 consisted of strikes in 14 mines, which rendered 1,705 men idle for 48 days. The total working time lost amounted to 82,730 days. These figures compare with 18 mines having labor troubles in 1900, and with 1,559 men idle for an average of 43 days each, or a total loss of 67,309 days.

The statistics of production during the last two years are shown in the following tables:

Coal production of Tennessee in 1900, by counties.

County.	Loaded at mines for shipment.	Sold to local trade and used by employees.	Used at mines for steam and heat.	Made into coke.	Total production.	Total value.	Average price per ton.	Average number of days active.	Average number of employees.
	Short tons.	*Short tons.*	*Short tons.*	*Short tons.*	*Short tons.*				
Anderson	659,371	6,725	6,656	....	672,752	$718,113	$1.07	234	1,580
Campbell	491,014	8,243	3,734	....	502,991	613,891	1.22	199	1,287
Claiborne	333,567	11,100	4,700	43,332	392,699	411,775	1.05	227	625
Hamilton	139,964	1,894	1,870	83,335	227,063	278,661	1.23	236	490
Marion	226,216	1,616	3,092	79,806	310,730	408,658	1.32	233	667
Morgan	301,809	1,002	500	84,831	388,142	394,122	1.02	280	683
Rhea	40,758	2,075	2,606	165,089	210,528	199,417	.95	264	697
Scott	69,901	11,840	5,000	13,597	100,338	110,679	1.10	238	368
Cumberland, Grundy, and Putnam	154,148	213	4,120	149,080	307,561	383,469	1.24	286	451
Roane and White	198,505	14,112	17,173	162,468	392,258	479,797	1.22	281	798
Small mines	....	4,500	....	....	4,500	4,500	......	......	....
Total	2,615,253	63,320	49,451	781,538	3,509,562	4,003,082	1.14	242	7,646

Coal production of Tennessee in 1901, by counties.

County.	Loaded at mines for shipment.	Sold to local trade and used by employees.	Used at mines for steam and heat.	Made into coke.	Total production.	Total value.	Average price per ton.	Average number of days active.	Average number of employees.
	Short tons.	*Short tons.*	*Short tons.*	*Short tons.*	*Short tons.*				
Anderson	633,998	11,535	18,876	....	664,409	$738,095	$1.11	210	1,774
Campbell	544,286	12,050	8,507	5,500	570,343	727,170	1.27	195	1,542
Claiborne	419,698	6,840	2,900	22,152	451,590	454,342	1.01	204	639
Hamilton	153,883	2,370	1,995	84,745	242,993	257,588	1.06	242	640
Marion	227,801	3,798	3,220	72,790	307,609	373,435	1.21	260	646
Morgan	277,988	1,062	180	87,774	367,004	383,134	1.04	224	1,563
Rhea	6,722	7,748	3,406	165,129	183,005	183,649	1.00	255	344
Scott	72,025	12,453	4,176	14,000	102,654	109,325	1.06	221	343
Cumberland, Grundy, and Putnam	285,135	1,826	3,723	97,052	387,736	431,923	1.11	245	835
Roane and White	186,395	14,797	13,478	136,777	351,447	404,228	1.15	294	720
Small mines	....	4,500	....	....	4,500	4,500	....	....	....
Total	2,807,931	78,979	60,461	685,919	3,633,290	4,067,389	1.12	228	9,046

The distribution of the product for consumption in the last thirteen years was as follows:

Distribution of the coal product of Tennessee from 1889 to 1901, inclusive.

Year.	Loaded at mines for shipment.	Sold to local trade and used by employees.	Used at mines for steam and heat.	Made into coke.	Total product.	Total value.	Average price per ton.	Average number of days active.	Average number of employees.
	Short tons.	*Short tons.*	*Short tons.*	*Short tons.*	*Short tons.*				
1889	1,334,424	29,101	23,034	539,130	1,925,689	$2,238,309	$1.21	....	4,108
1890	1,482,357	41,932	23,583	621,713	2,169,585	2,395,746	1.10	263	5,082
1891	1,626,964	100,478	33,302	652,934	2,413,678	2,668,188	1.105	230	5,097
1892	1,448,262	55,452	17,037	571,313	2,092,064	2,355,441	1.13	240	4,926
1893	1,427,219	42,560	20,921	411,558	1,902,258	2,048,449	1.08	232	4,976
1894	1,571,406	59,985	28,993	520,495	2,180,879	2,119,481	.97	210	5,542
1895	1,808,056	51,923	25,477	650,188	2,535,644	2,349,032	.93	224	5,120
1896	1,990,538	43,752	40,343	588,473	2,663,106	2,281,295	.86	211	6,531
1897	2,150,179	37,620	39,275	661,775	2,888,849	2,329,534	.81	221	6,337
1898	2,199,075	37,971	52,523	733,327	3,022,896	2,337,512	.77	234	6,643
1899	2,444,655	86,351	55,675	743,978	3,330,659	2,940,644	.88	252	6,949
1900	2,615,253	66,320	49,451	781,538	3,509,562	4,003,082	1.14	242	7,646
1901	2,807,931	78,979	60,461	685,919	3,633,290	4,067,389	1.12	228	9,046

In the following table is given the production, by counties, during the last five years, with the increases and decreases in 1901 as compared with 1900:

Coal production of Tennessee since 1897, by counties

[Short tons.]

County.	1897.	1898.	1899.	1900.	1901.	Increase, 1901.	Decrease, 1901.
Anderson	557,696	578,866	637,214	672.752	664,409	....	8,343
Campbell	328,494	325,757	429,717	502,991	570,343	67,352	....
Claiborne	270,927	298,574	387,499	392,699	451,590	58,891	....
Cumberland	....	....	1,080	88	55,327	55,239	....
Grundy	317,924	251,806	305,736	300,198	326,990	26,792	....
Hamilton	211,959	199,828	199,230	227,063	242.993	15,930	....
Marion	312,241	309,665	339,366	310,730	307,609	....	3,121
Morgan	301,694	339,292	350,336	388.142	367,004	....	21,138
Putnam	10,816	11,450	8,586	7,275	3,648	....	3,627
Rhea	139,072	184,239	181,428	210,528	183,005	....	27,523
Roane	173,383	170,556	162,441	181.753	159,221	....	22,532
Scott	88,312	145,216	157,256	100,338	102.654	2,316	....
White	171,831	203,047	166,270	210,505	192,226	....	18,279
Other counties and small mines	4,500	4,600	4,500	4,500	6,271	1,771	....
Total	2,888,849	3,022,896	3,330,659	3,509,562	3,633,290	228,291	104,563
Net increase	225,743	134,047	307,763	178,903	123,728	123,728	....

The annual output of the State since 1873 has been as follows:

Coal production of Tennessee from 1873 to 1901, inclusive.

[Short tons.]

Year.	Quantity.	Year.	Quantity.
1873	350,000	1888	1,967,297
1874	350,000	1889	1,925,689
1875	360,000	1890	2,169,585
1876	550,000	1891	2,413,678
1877	450,000	1892	2,092,064
1878	375,000	1893	1,902,258
1879	450,000	1894	2,180,879
1880	641,042	1895	2,535,644
1881	750,000	1896	2,663,106
1882	850,000	1897	2,888,849
1883	1,000,000	1898	3,022,896
1884	1,200,000	1899	3,330,659
1885	1,440,957	1900	3,509,562
1886	1,714,290	1901	3,633,290
1887	1,900,000		

TEXAS

Total production in 1901, 1,107,953 short tons; spot value, $1,907,024.

The coal production in Texas continues to keep pace with the industrial development of that State, notwithstanding the competition of fuel oil which has been brought about by the development of the Beaumont and other petroleum sections of the State. The output of coal in 1901 reached a total exceeding 1,000,000 tons for the first time in the history of the State. The growth of the coal-mining industry in Texas has been exceptionally rapid, particularly during the last ten years. In 1891 it amounted to only 172,100 short tons, and has increased each year without exception since that time. The production in 1896 was more than three times that of 1891. The production in 1901 was more than double that of 1896. As compared with 1900, the production in 1901 showed an increase of 139,580 short tons, or 14.4 per cent. The value of the product in 1901 over 1900 showed an increase of $325,110, or a little over 20 per cent. In spite of the increased competition of oil fuel referred to, the average price for the Texas coal product advanced from $1.63 in 1900 to $1.72 in 1901. This advance in price was altogether in that of bituminous coal, the largest part of which is produced in the northern portion of the State. Lignite coal, which is produced in the eastern central portion of the State, declined in price from 91 cents in 1900 to 83 cents in 1901. This decline in price of lignite coal is probably due to the fact that it came more directly in competition with the fuel oil from Beaumont; also to the fact that it is largely consumed in cotton gins, and the year 1901 was one of a short cotton crop in this State. There were 14 counties in the State which produced coal in 1901, a gain of 2 over 1900. In 8 of these 14 counties the product is bituminous coal. These counties are Coleman, Eastland, Erath, Maverick, Palo Pinto, Parker, Webb, and Wise. The counties in which lignite coal is produced are Bastrop, Medina, Milam, Robertson, Shelby, and Wood. Eastland County was added to the bituminous producers for the first time in 1901, and Shelby County was added to the lignite producers.

The total production of bituminous coal in the State in 1901 was 804,798 short tons, valued at $1,655,736, as against 715,461 short tons, valued at $1,350,607, in 1900. The production of lignite last year amounted to 303,155 short tons, valued at $251,288, as against 252,912 short tons, valued at $231,307, in the preceding year.

The statistics of production in 1900 and 1901 are shown in the following tables:

Coal production of Texas in 1900, by counties.

County.	Loaded at mines for shipment.	Sold to local trade and used by employees.	Used at mines for steam and heat.	Total production.	Total value.	Average price per ton.	Average number of days active.	Average number of employees.
	Short tons.	*Short tons.*	*Short tons.*	*Short tons.*				
Bituminous:								
Coleman	706,033	3,573	5,855	715,461	$1,350,607	$1.89	247	2,443
Erath								
Maverick								
Palo Pinto								
Parker								
Webb								
Wise								
Lignite:								
Bastrop	248,488	745	3,679	252,912	231,307	.91	238	401
Medina								
Milam								
Robertson								
Wood								
Total	954,521	4,318	9,534	968,373	1,581,914	1.63	246	2,844

Coal production of Texas in 1901, by counties.

County.	Loaded at mines for shipment.	Sold to local trade and used by employees.	Used at mines for steam and heat.	Total production.	Total value.	Average price per ton.	Average number of days active.	Average number of employees.
	Short tons.	*Short tons.*	*Short tons.*	*Short tons.*				
Bitumimous:								
Coleman	787,700	4,203	12,895	804,798	$1,655,736	$2.06	267	2,616
Eastland								
Erath								
Maverick								
Palo Pinto								
Parker								
Webb								
Wise								
Lignite								
Bastrop	296,681	222	6,252	303,155	251,288	.83	248	435
Medina								
Milam								
Robertson								
Shelby								
Wood								
Total	1,084,381	4,425	19,147	1,107,953	1,907,024	1.72	264	3,051

In the following table is shown the record of production since 1889:

Coal production of Texas since 1889.

Distribution.	1889.	1890.	1891.	1892.	1893.	1894.	1895.
	Short tons.	*Short tons.*	*Short tons.*	*Short tons.*	*Short tons.*	*Short tons.*	*Short tons.*
Loaded at mines for shipment	120, 602	180, 800	169, 300	241, 005	300, 064	417, 281	475, 157
Sold to local trade and used by employees	6, 552	1, 840	900	4, 460	462	2, 412	7, 705
Used at mines for steam and heat	1, 062	1, 800	1, 900	225	1, 680	1, 155	2, 097
Total	128, 216	184, 440	172, 100	245, 690	302, 206	420, 848	484, 959
Total value	$340, 617	$465, 900	$412, 300	$569, 333	$688, 407	$976, 458	$913, 138

Distribution.	1896.	1897.	1898.	1899.	1900.	1901.
	Short tons.	*Short tons.*	*Short tons.*	*Short tons.*	*Short tons.*	*Short tons.*
Loaded at mines for shipment	522, 177	621, 635	678, 732	839, 166	954, 521	1, 084, 381
Sold to local trade and used by employees	12, 846	8, 357	3, 247	34, 690	4, 318	4, 425
Used at mines for steam and heat	8, 992	9, 349	4, 755	9, 976	9, 534	19, 147
Total	544, 015	639, 341	686, 734	883, 832	968, 373	1, 107, 953
Total value	$896, 251	$972, 323	$1, 139, 763	$1, 334, 895	$1, 581, 914	$1, 907, 024

UTAH.

Total production in 1901, 1,322,614 short tons; spot value, $1,666,082.

Utah is numbered among the 23 States whose output in 1901 exceeded that of the preceding year, and which also attained its maximum production in 1901. The development of the coal-mining industry in this State in the last five years has been one worthy of special notice. In 1896 the coal production of Utah amounted to only 418,627 short tons. It increased about 25 per cent in 1897, about 12 per cent more in 1898, and during the last three years has made remarkable strides. The production in 1901 was more than three times that of 1896 and more than two and one-half times that of 1897. As compared with 1900, it shows an increase of 175,587 short tons, or 15.3 per cent. The value increased $218,332, or about 15 per cent.

Carbon County remains, by long odds, the most important producing county in the State, with 95 per cent of the total production. Practically all the increase in 1901 over 1900 was also in the output of Carbon County.

The statistics of production of the State in the last two years are shown in the following tables:

Coal production of Utah in 1900, by counties.

County.	Loaded at mines for shipment.	Sold to local trade and used by employees.	Used at mines for steam and heat.	Made into coke.	Total production.	Total value.	Average price per ton.	Average number of days active.	Average number of employees.
	Short tons.	*Short tons.*	*Short tons.*	*Short tons.*	*Short tons.*				
Carbon	1,036,951	7,145	14,965	28,299	1,087,360	$1,360,835	$1.25	253	1,168
Iron		661	10		671	1,527	2.28	50	11
Summit	42,222	4,818	3,650		50,690	70,404	1.39	250	89
Uinta		3,816	25		3,841	6,504	1.69	122	20
Emery Sanpete	3,550	915			4,465	8,480	1.90	181	20
Total	1,082,723	17,355	18,650	28,299	1,147,027	1,447,750	1.26	248	1,308

Coal production of Utah in 1901, by counties.

County.	Loaded at mines for shipment.	Sold to local trade and used by employees.	Used at mines for steam and heat.	Made into coke.	Total production.	Total value.	Average price per ton.	Average number of days active.	Average number of employees.
	Short tons.	*Short tons.*	*Short tons.*	*Short tons.*	*Short tons.*				
Carbon	1,225,179	6,824	26,257	987	1,259,247	$1,574,168	$1.25	263	1,565
Iron									
Summit	45,184	3,542	4,161		52,887	73,564	1.39	233	108
Uinta		6,068	8		6,076	9,546	1.57	200	18
Emery Sanpete	2,485	1,899	20		4,404	8,804	2.00	144	21
Total	1,272,848	18,333	30,446	987	1,322,614	1,666,082	1.26	259	1,712

The distribution of the product since 1891 and the total output since 1885 are shown in the following tables:

Distribution of the coal product of Utah since 1891.

Year.	Loaded at mines for shipment.	Sold to local trade and used by employees.	Used at mines for steam and heat.	Made into coke.	Total product.	Total value.	Average price per ton.	Average number of days active.	Average number of employees.
	Short tons.	*Short tons.*	*Short tons.*	*Short tons.*	*Short tons.*				
1891	315,711	8,233	21,650	25,451	371,045	$666,646	$1.80		621
1892	321,431	6,775	6,509	26,298	361,013	562,625	1.56	230	646
1893	350,423	7,649	4,258	50,875	413,205	611,092	1.48	226	576
1894	364,675	11,173	6,892	48,810	431,550	603,479	1.40	199	671
1895	376,479	25,097	7,253	63,027	471,856	617,349	1.31	203	670
1896	340,338	9,171	7,411	61,707	418,627	500,547	1.20	202	679
1897	424,770	22,667	9,198	64,925	521,560	618,230	1.19	204	704
1898	485,716	11,542	9,845	86,606	593,709	752,252	1.27	243	739
1899	753,881	13,303	13,046	5,819	786,049	997,271	1.27	265	743
1900	1,082,723	17,355	18,650	28,299	1,147,027	1,447,027	1.26	246	1,308
1901	1,272,848	18,333	30,446	987	1,322,614	1,666,082	1.26	259	1,712

Coal production of Utah since 1885.

[Short tons.]

Year.	Quantity.
1885	213,120
1886	200,000
1887	180,021
1888	258,961
1889	236,651
1890	318,159
1891	371,045
1892	361,013
1893	413,205
1894	431,550
1895	471,836
1896	418,627
1897	521,560
1898	593,709
1899	786,049
1900	1,147,027
1901	1,322,614

VIRGINIA.

Total production in 1901, 2,725,873 short tons; spot value, $2,353,989.

Virginia is included in the number of coal-producing States whose production in the first year of the twentieth century exceeded that of any year of previous history. In 1899 Virginia exceeded for the first time a total production of 2,000,000 short tons. The production for 1900 exceeded that of 1899 by 287,963 short tons, or 13.7 per cent, and 1901 shows an increase over 1900 of 332,119 short tons, or 13.8 per cent.

There are only two really important coal-producing counties in the State, Tazewell and Wise. The production of Tazewell County in 1901 was interrupted to a considerable extent by a disastrous fire in the mines at Pocahontas which, in addition to damage to property and loss in output, resulted in the death of a number of men. The production in this county decreased nearly 200,000 tons. This was more than made up, however, by the increased activity in the Wise County mines, which include those along the Clinch River Division of the Northwestern Railroad. The production of Wise County in 1901 showed an increase of over 550,000 tons, or over 40 per cent more than that of 1900. The attempts to reestablish the industry in the Richmond coal basin of Chesterfield and Henrico counties have not met with abundant success, and operations there have been practically suspended.

The statistics of production in Virginia during the last two years are shown in the following tables:

Coal production of Virginia in 1900, by counties.

County.	Loaded at mines for shipment.	Sold to local trade and used by employees.	Used at mines for steam and heat.	Made into coke.	Total production.	Total value.	Average price per ton.	Average number of days active.	Average number of employees.
	Short tons.	*Short tons.*	*Short tons.*	*Short tons.*	*Short tons.*				
Montgomery ..	6,065	3,594	155	....	9,814	$20,589	$2.10	186	55
Tazewell	722,160	4,310	10,876	233,520	970,866	869,066	.90	222	850
Wise	574,171	37,576	12,592	739,231	1,363,570	1,144,715	.84	245	2,633
Chesterfield ... Henrico .... Pulaski	32,263	225	17,016	....	49,504	88,852	1.79	255	93
Total	1,334,659	45,705	40,639	972,751	2,393,754	2,123,222	.89	239	3,631

Coal production of Virginia in 1901, by counties.

County.	Loaded at mines for shipment.	Sold to local trade and used by employees.	Used at mines for steam and heat.	Made into coke.	Total production.	Total value.	Average price per ton.	Average number of days active.	Average number of employees.
	Short tons.	*Short tons.*	*Short tons.*	*Short tons.*	*Short tons.*				
Montgomery ..	5,975	4,902	300	....	11,177	$22,670	$2.03	178	53
Tazewell	532,872	5,869	12,161	225,666	776,568	762,448	.98	245	1,105
Wise	834,122	5,240	14,611	1,064,720	1,918,693	1,537,667	.80	295	2,894
Chesterfield ... Henrico .... Pulaski	17,755	....	1,680	....	19,435	31,204	1.60	275	100
Total	1,390,724	16,011	28,752	1,290,386	2,725,873	2,353,989	.86	279	4,152

Since 1889 the distribution of the coal product of Virginia has been as follows:

Distribution of the coal product of Virginia from 1889 to 1901, inclusive.

Year.	Loaded at mines for shipment.	Sold to local trade and used by employees.	Used at mines for steam and heat.	Made into coke.	Total product.	Total value.	Average price per ton.	Average number of days active.	Average number of employees.
	Short tons.	*Short tons.*	*Short tons.*	*Short tons.*	*Short tons.*				
1889.......	732,881	13,179	7,516	112,210	865,786	$804,475	$0.93	....	1,555
1890.......	608,641	17,002	4,908	153,460	784,011	589,925	.75	296	1,295
1891.......	583,082	16,685	3,178	133,454	736,399	611,654	.83	246	820
1892.......	527,304	20,721	6,611	120,569	675,205	578,429	.86	192	836
1893.......	714,188	20,578	4,609	80,964	820,339	692,748	.84	253	961
1894.......	1,015,713	21,162	4,690	187,518	1,229,083	933,576	.76	234	1,635
1895.......	1,024,200	15,173	22,338	306,613	1,368,324	869,873	.63	225	2,158
1896.......	824,042	40,951	38,540	351,190	1,254,723	848,851	.68	198	2,510
1897.......	969,973	29,017	43,087	486,225	1,528,302	1,021,918	.67	213	2,344
1898.......	1,029,185	19,564	16,234	750,291	1,815,274	1,070,417	.59	230	1,855
1899.......	1,175,504	23,634	19,004	887,649	2,105,791	1,304,241	.62	252	1,960
1900.......	1,334,659	45,705	40,639	972,751	2,393,754	2,123,222	.89	239	3,631
1901.......	1,390,724	16,011	28,752	1,290,386	2,725,873	2,353,989	.86	279	4,152

The total amount of coal produced in Virginia since 1880, the first year for which the statistics are available, is shown in the following table:

Coal production of Virginia since 1880.

[Short tons.]

Year.	Quantity.	Value.	Average price per ton.	Year.	Quantity.	Value.	Average price per ton.
1880	112,000	....	....	1891	736,399	$611,654	$0.83
1881	112,000	....	....	1892	675,205	578,429	.86
1882	112,000	....	....	1893	820,339	692,748	.84
1883	252,000	....	....	1894	1,299,083	933,576	.76
1884	336,000	....	....	1895	1,368,324	869,873	.63
1885	567,000	....	....	1896	1,254,723	848,851	.68
1886	684,951	....	....	1897	1,528,302	1,021,918	.67
1887	825,263	....	....	1898	1,815,274	1,070,417	.59
1888	1,073,000	....	....	1899	2,105,791	1,304,241	.62
1889	865,786	$804,475	$0.93	1900	2,393,754	2,123,222	.89
1890	784,011	589,925	.75	1901	2,725,873	2,353,989	.86

WASHINGTON.

Total production in 1901, 2,578,217 short tons; spot value, $4,271,076.

Washington is the only one of the Pacific Coast States whose coal production amounts to 1 per cent of the total production of the United States. It is also the only one in which bituminous coal of coking quality has been obtained, all the coal so far produced both in California and Oregon being lignite. Some of the Washington coals approach anthracite in character, and some natural coke has been produced. The coal production in the State has increased steadily since 1894, the output in 1901 being 104,124 short tons, or 4.2 per cent more than that of 1900, and more than double that of any other year prior to 1897. Moreover, there is a favorable outlook in the future for the coal-mining industry of Washington. The development of the other mining industries and the construction of smelters on the coast are in active progress.

Of the total production in 1901, 6,500 tons were undercut by the use of machines, as compared with 10,000 tons in 1900. Only one firm in the State uses machines, and four machines were used during the last year.

The statistics of production in 1900 and 1901 are shown in the following tables:

Coal production of Washington in 1900, by counties.

County.	Loaded at mines for shipment.	Sold to local trade and used by employees.	Used at mines for steam and heat.	Made into coke.	Total production.	Total value.	Average price per ton.	Average number of days active.	Average number of employees.
	Short tons.	*Short tons.*	*Short tons.*	*Short tons.*	*Short tons.*				
King	940,637	18,227	44,237	....	1,003,101	$2,137,380	$2.13	267	1,580
Kittitas	857,808	4,570	11,373	....	873,751	1,313,477	1.50	308	1,105
Pierce	508,250	2,433	13,304	53,140	577,127	1,192,321	2.07	280	911
Cowlitz, Lewis, Skagit, and Whatcom	12,202	890	874	6,148	20,114	56,890	2.83	288	74
Total	2,318,897	26,120	69,788	59,288	2,474,093	4,700,068	1.90	289	3,670

Coal production of Washington in 1901, by counties.

County.	Loaded at mines for shipment.	Sold to local trade and used by employees.	Used at mines for steam and heat.	Made into coke.	Total production.	Total value.	Average price per ton.	Average number of days active.	Average number of employees.
	Short tons.	*Short tons.*	*Short tons.*	*Short tons.*	*Short tons.*				
King	899,014	9,033	49,502	....	957,549	$1,430,664	$1.49	254	1,850
Kittitas	991,458	5,984	12,159	2,920	1,012,521	1,513,053	1.49	300	1,515
Pierce	497,282	3,016	14,017	71,669	585,984	1,262,792	2.15	284	1,131
Cowlitz, Lewis, Skagit and Whatcom	12,522	520	....	9,121	22,163	64,567	2.91	210	49
Total	2,400,276	18,553	75,678	83,710	2,578,217	4,271,076	1.66	276	4,545

The distribution of the product from 1889 to 1901 has been as follows:

Distribution of the coal product of Washington from 1889 to 1901, inclusive.

Year.	Loaded at mines for shipment.	Sold to local trade and used by employees.	Used at mines for steam and heat.	Made into coke.	Total product.	Total value.	Average price per ton.	Average number of days active.	Average number of employees.
	Short tons.	*Short tons.*	*Short tons.*	*Short tons.*	*Short tons.*				
1889	956,046	15,574	19,958	39,000	1,030,578	$2,393,238	$2.32	....	2,657
1890	1,212,621	17,249	17,019	16,800	1,263,689	3,426,590	2.71	270	2,206
1891	1,008,496	12,025	20,428	15,300	1,056,249	2,437,270	2.31	211	2,447
1892	1,150,865	9,802	40,085	12,675	1,213,427	2,763,547	2.28	247	2,564
1893	1,186,109	18,888	48,506	11,374	1,264,877	2,920,876	2.31	241	2,757
1894	1,030,232	10,822	56,853	8,563	1,106,470	2,578,441	2.33	207	2,662
1895	1,108,868	16,320	43,249	22,973	1,191,410	2,577,958	2.16	224	2,840
1896	1,095,484	16,722	44,613	38,685	1,195,504	2,396,078	2.00	221	2,622
1897	1,347,915	7,149	39,902	39,146	1,434,112	2,777,687	1.94	236	2,739
1898	1,748,411	30,636	56,966	48,558	1,884,571	3,352,798	1.78	270	3,145
1899	1,897,962	20,281	61,443	50,195	2,029,881	3,603,989	1.78	259	3,330
1900	2,318,897	26,120	69,788	59,288	2,474,093	4,700,068	1.90	289	3,670
1901	2,400,276	18,553	75,678	83,710	2,578,217	4,271,076	1.66	276	4,545

The following tables show the production, by counties, during the last six years, with the increases and decreases in 1901, as compared with 1900. It will be observed that King County, which has held first place for a number of years, decreased its output by 45,552 tons, and that Kittitas County increased its production by 138,770 tons and displaced King County as the most important producing county in the State.

Production of coal in Washington since 1896, by counties.

[Short tons.]

County.	1896.	1897.	1898.	1899.	1900.	1901.	Increase, 1901.	Decrease, 1901.
Cowlitz	1,263	1,248	1,088	480	500	....	....	500
King	481,710	583,488	785,806	847,303	1,003,101	957,549	....	45,552
Kittitas	265,953	370,657	566,396	661,210	873,751	1,012,521	138,770	....
Lewis	....	....	760	300	300	520	220	....
Pierce	419,568	458,394	509,142	506,385	577,127	585,984	8,857	....
Skagit	18,548	13,825	12,226	6,755	10,130	12,643	2,513	....
Whatcom	8,462	[a]6,500	9,153	7,448	9,184	9,000	....	184
Total	1,195,504	1,434,112	1,884,571	2,029,881	2,474,093	2,578,217	[b]104,124	....

[a] Including Thurston County.

[b] Net increase.

The total production for the State since 1885 has been as follows:

Production of coal in Washington since 1885.

Year.	Total production.	Total value.	Average price per ton.	Year.	Total production.	Total value.	Average price per ton.
	Short tons.				*Short tons.*		
1885	380,250	....	....	1894	1,106,470	$2,578,441	$2.33
1886	423,525	$952,931	$2.25	1895	1,191,410	2,577,958	2.16
1887	772,601	1,699,746	2.19	1896	1,195,504	2,396,078	2.00
1888	1,215,750	3,647,250	3.00	1897	1,434,112	2,777,687	1.94
1889	1,030,578	2,393,238	2.32	1898	1,884,571	3,352,798	1.78
1890	1,263,689	3,426,590	2.71	1899	2,029,881	3,603,989	1.78
1891	1,056,249	2,437,270	2.31	1900	2,474,093	4,700,068	1.90
1892	1,213,427	2,763,547	2.28	1901	2,578,217	4,271,076	1.66
1893	1,264,877	2,920,876	2.31				

WEST VIRGINIA.

Total production in 1901, 24,068,402 short tons; spot value, $20.848.184.

The coal production of West Virginia in 1901 shows an increase of 1,421,195 short tons, or 6.3 per cent in amount, and of $2,431,313, or 13 per cent in value. The record of West Virginia as a coal-producing State is one without parallel in the history of our development. During the last twenty-one years there has been only one instance in which the production of West Virginia was less than that of the preceding year. This was in 1895, and was due to two causes. One was the general strike which prevailed in the Pocahontas region, and which resulted in a decrease of 1,150,000 tons in the counties of McDowell and Mercer, and the other was the general business depression which affected the coal-mining industry and all industries in every State during that year. Notwithstanding the loss of 1,150,000 tons in McDowell and Mercer counties, and the general depression, the total production of the State decreased in that year only 240,000 tons. During the twenty-one years that the history of coal production has been recorded in the volumes of "Mineral Resources of the United States," the coal production of West Virginia has increased an average of over 1,000,000 tons each year. Notwithstanding its decreased production in 1895, West Virginia in that year exceeded the output of Ohio, which, up to that time, held third place as a coal producer. Since that time West Virginia has been gradually approaching Illinois, which ranks second to Pennsylvania, but has not fulfilled a prediction made some years ago that by the beginning of the present century West Virginia would rank next to Pennsylvania as a coal-producing State.

There is another respect in which the coal-mining industry of West Virginia stands distinctly alone. This is in the fact that although its production now approaches 25,000,000 tons per year, the amount of this fuel consumed within the State's borders is almost insignificant, if the amount consumed by the transportation companies is excluded. There are some iron and steel manufacturing industries in Wheeling and vicinity which utilize West Virginia coal, but except for these the manufacturing industries in the State are almost entirely undeveloped and by far the greater proportion of the fuel taken from West Virginia mines goes to feed and support the manufacturing enterprises of neighboring States. This has probably been the result of the fact that the railroad companies penetrating the coal fields have been identified with the coal-mining interests and have been glad to get the advantage of long hauls in the way of transportation. Some of the West Virginia coals are highly prized, both for steam raising and for coke making. They are used to a large extent by the United States Government for naval vessels, and are shipped either in the form of coal or coke to blast furnaces and steel works as far from the coal regions as Chicago and Milwaukee, in competition with fuels mined almost in the immediate vicinity of these cities.

The statistics of the use of mining machines in West Virginia show that there were 403 machines in use in 1901, and that they produced a total of 4,817,943 tons, as compared with 327 machines which produced 3,418,377 tons in 1900, and 154 machines which produced 1,181,125 tons in 1899.

The details of production in 1900 and 1901, by counties, with the distribution of the product for consumption, are shown in the following tables:

Coal production of West Virginia in 1900, by counties.

County.	Loaded at mines for shipment.	Sold to local trade and used by employees.	Used at mines for steam and heat.	Made into coke.	Total production.	Total value.	Average price per ton.	Average number of days active.	Average number of employees.
	Short tons.	*Short tons.*	*Short tons.*	*Short tons.*	*Short tons.*				
Barbour	189,031	1,796	3,050	22,354	216,231	$146,149	$0.68	150	689
Brooke	46,905	13,965	100	....	60,970	54,364	.89	270	91
Fayette	4,896,223	47,903	39,560	758,452	5,742,138	5,028,501	.88	235	7,779
Harrison	912,837	11,227	9,092	12,799	945,955	687,882	.74	178	1,969
Kanawha	1,930,930	38,704	11,991	81,116	2,062,741	1,883,095	.91	232	3,501
McDowell	3,203,626	26,510	22,181	1,668,918	4,921,235	3,873,297	.80	246	4,452
Marion	2,806,370	17,173	24,652	393,480	3,241,675	2,570,780	.79	246	3,355
Marshall	209,296	17,417	4,858	....	231,571	219,949	.95	275	277
Mason	112,953	28,710	546	....	142,209	129,036	.91	252	250
Mercer	744,604	5,977	3,941	255,014	1,009,536	762,351	.76	241	995
Mineral	609,412	31,522	222	....	641,156	446,854	.70	220	589
Mingo	567,338	4,914	1,904	....	574,156	425,144	.74	261	995
Monongalia	71,766	616	1,386	13,632	87,400	97,375	1.11	191	108
Ohio	84,577	51,964	1,255	....	137,796	127,073	.92	177	260
Preston	369,960	1,148	3,203	7,636	381,947	299,033	.78	245	512
Putnam	137,285	185	400	....	137,870	154,502	1.12	191	386
Randolph	159,108	443	765	19,272	179,588	117,620	.65	257	325
Taylor	514,330	7,696	1,232	....	523,258	392,317	.75	182	810
Tucker	711,898	42,866	11,313	413,976	1,180,053	782,764	.66	235	1,588
Hancock and Raleigh	69,713	18,315	420	16,274	104,722	93,785	.90	249	232
Small mines	....	125,000	....	....	125,000	125,000	....	....	....
Total	18,348,162	494,051	142,071	3,662,923	22,647,207	18,416,871	.81	231	29,163

Coal production of West Virginia in 1901, by counties.

County.	Loaded at mines for shipment.	Sold to local trade and used by employees.	Used at mines for steam and heat.	Made into coke.	Total production.	Total value.	Average price per ton.	Average number of days active.	Average number of employees.
	Short tons.	*Short tons.*	*Short tons.*	*Short tons.*	*Short tons.*				
Barbour	266,048	11,287	18,111	17,930	313,376	$228,635	$0.73	218	482
Brooke	68,279	4,838	81	....	73,198	70,134	.96	272	119
Fayette	5,090,139	80,602	66,202	815,446	6,052,389	5,417,032	.90	207	9,207
Harrison	1,728,008	7,996	18,880	7,679	1,762,563	1,394,109	.79	211	1,936
Kanawha	1,878,056	35,747	17,981	52,119	1,983,903	1,782,509	.90	229	3,073
McDowell	3,386,075	40,063	34,187	1,535,186	4,995,511	4,506,511	.90	232	5,178
Marion	3,089,516	17,054	45,053	259,974	3,411,597	2,737,443	.80	215	3,050
Marshall	181,638	31,147	4,452	....	217,237	191,069	.88	290	284
Mason	74,322	42,109	13,533	....	129,964	116,553	.90	192	302
Mercer	676,112	7,736	4,994	275,186	964,028	828,609	.86	239	962
Mineral	593,529	3,706	541	....	597,776	443,472	.74	247	676
Mingo	567,626	4,851	4,409	....	576,886	454,344	.79	254	1,219
Monongalia	89,019	699	184	20,899	110,801	93,713	.85	246	107
Ohio	87,011	103,404	1,346	....	191,761	180,564	.94	276	261
Preston	470,877	1,408	4,076	12,878	489,239	681,647	1.39	224	517
Putnam	237,163	4,270	1,356	....	242,789	237,044	.98	230	691
Randolph	139,339	1,187	679	20,356	161,561	124,229	.77	185	266
Taylor	371,595	7,127	1,868	....	380,590	279,731	.73	192	529
Tucker	713,645	6,273	16,846	360,576	1,097,340	778,045	.71	247	1,689
Hancock and Raleigh	151,812	38,242	839	....	190,893	177,791	.93	165	387
Small mines	....	125,000	....	....	125,000	125,000	......	....	....
Total	19,859,809	574,746	255,618	3,378,229	24,068,402	20,848,184	.87	219	30,935

The distribution of the total product since 1889 has been as follows:

Distribution of the coal product of West Virginia from 1889 to 1901, inclusive.

Year.	Loaded at mines for shipment.	Sold to local trade and used by employees.	Used at mines for steam and heat.	Made into coke.	Total product.	Total value.	Average price per ton.	Average number of days active.	Average number of employees.
	Short tons.	*Short tons.*	*Short tons.*	*Short tons.*	*Short tons.*				
1889	4,764,900	493,287	37,368	936,325	6,231,880	$5,086,584	$0.82	....	9,952
1890	5,614,752	438,527	30,594	1,310,781	7,394,654	6,208,128	.84	227	12,236
1891	6,887,151	429,878	47,163	1,856,473	9,220,665	7,359,816	.80	237	14,227
1892	7,560,790	441,159	49,563	1,687,243	9,738,755	7,852,114	.80	228	14,867
1893	8,591,962	390,689	46,898	1,679,029	10,708,578	8,251,170	.77	219	16,524
1894	9,116,314	428,202	64,126	2,019,115	11,627,757	8,706,808	.75	186	17,824
1895	8,858,256	445,023	50,595	2,034,087	11,387.961	7,710,575	.68	195	19,159
1896	9,838,053	426,441	56,395	2,555,407	12,876,296	8,336,685	.65	201	19,078
1897	11,312,408	446,795	58,694	2,430,262	14,248,159	8,987,393	.63	205	20,504
1898	12,965,903	471,796	61,176	3,202,124	16,700,999	10,131,264	.61	218	21,607
1899	15,044,272	476,996	87,022	3,644,705	19,252,995	12,053,268	.63	242	23,625
1900	18,348,162	494,051	142,071	3,662,923	22,647,207	18,416,871	.81	231	29,163
1901	19,859,809	574,746	255,618	3,378,229	24,068,402	20,848,184	.87	219	30,935

In the following table is shown the production in West Virginia, by counties, during the last five years, together with the increases and decreases in 1901, as compared with 1900:

Coal production of West Virginia from 1897 to 1901, inclusive, by counties.

[Short tons.]

County.	1897.	1898.	1899.	1900.	1901.	Increase, 1901.	Decrease, 1901.	Per cent of increase.	Per cent of decrease.
Barbour	56,054	35,643	79,735	216,231	313,376	97,145	....	44.9	....
Brooke	49,453	78,055	77,246	60,970	73,198	12,228	....	20.0	....
Fayette	4,001,540	4,592,772	5,039,815	5,742,138	6,052,389	310,251	....	5.4	....
Grant	28	560	....	....	....	....	....	....	....
Harrison	334,817	410,942	641,022	945,955	1,762,563	816,608	....	86.3	....
Kanawha	920,161	1,354,500	1,505,141	2,062,741	1,983,903	....	78,838	....	3.8
McDowell	3,235,344	3,904,976	4,290,912	4,921,235	4,995,511	74,276	....	1.5	....
Marion	1,739,846	2,114,352	2,733,161	3,241,675	3,411,597	169,922	....	5.2	....
Marshall	147,532	195,232	239,436	231,571	217,237	....	14,334	....	6.2
Mason	120,945	116,026	97,233	142,209	129,964	....	12,245	....	8.6
Mercer	915,691	834,169	898,405	1,009,536	964,028	....	45,508	....	4.5
Mineral	580,520	586,345	628,539	641,156	597,776	....	43,380	....	6.8
Mingo	368,520	377,531	481,150	574,156	576,886	2,730	....	.5	....
Monongalia	51,307	35,750	51,520	87,400	110,801	23,401	....	26.8	....
Ohio	111,909	136,929	159,857	137,796	191,761	53,965	....	39.2	....
Preston	169,610	232,603	281,414	381,947	489,239	107,292	....	28.1	....
Putnam	110,971	206,407	210,821	137,870	242,789	104,919	....	76.1	....
Raleigh	83,178	99,852	86,088	90,507	148,493	57,986	....	64.1	....
Randolph	....	17,080	47,291	179,588	161,561	....	18,027	....	10.0
Taylor	281,227	260,146	378,765	523,258	380,590	....	142,668	....	27.3
Tucker	844,506	945,217	1,157,470	1,180,053	1,097,340	....	82,713	....	7.0
Other counties and small mines	125,000	165,912	167,974	139,215	167,400	28,185	....	20.2	....
Total	14,248,159	16,700,999	19,252,995	22,647,207	24,068,402	[a]1,421,195	....	6.3	....

[a] Net increase.

It will be observed that out of the twenty-one counties enumerated in the foregoing table, the production increased in thirteen and decreased in eight. The largest increase was in Harrison County, whose production in 1901 was nearly 90 per cent more than that of 1900, and the total increase for the county exceeded 800,000 tons. Fayette County increased 310,251 tons, or a little over 5 per cent, and was second in the amount of increase. Following these two counties in the order of amount of increase were Marion, Preston, Putnam, Barbour, and McDowell counties. The heaviest decrease was sustained by Taylor County, which lost 142,668 short tons, or 27.3 per cent. Tucker County fell off more than 80,000 tons, and Kanawha County nearly as much.

The principal coal-producing regions of West Virginia may be divided into four distinct districts. These may be distinguished by certain geographic or physiographic features. They do not include all of the coal-producing counties of the State, but do include the more important ones, and contributed nearly 90 per cent to the total output of the State. Two of these districts are in the northern part of the State, and two in the southern portion. The two in the northern portion of the State are designated, respectively, the Fairmont or Upper Monongahela district, and the Elk Garden or Upper Potomac. Those in the southern portion of the State are the Pocahontas or Flat Top district and the New and Kanawha River district. The Upper Monongahela district is penetrated by the Baltimore and Ohio Railroad, and sends its coal to market over that highway. The Upper Potomac region is also reached by the Baltimore and Ohio Railroad, and is penetrated by the West Virginia Central and Pittsburg Railroad. The Pocahontas or Flat Top region is tributary to the main branch of the Norfolk and Western Railroad. All of the product of this district goes either west or to tidewater over that line. The New and Kanawha River district is named from the two rivers which drain it, the coal being shipped partly by the Chesapeake and Ohio Railroad which passes through it, and partly by barges on the Kanawha River. The most important district from the productive point of view is the New and Kanawha River, which embraces the counties of Fayette and Kanawha. The coal from these two counties is drawn from two different areas, most of the coal from Kanawha County being from a lower geologic horizon than that of Fayette County, but the district is practically compact and continuous, is drained by the same waters and reached by the same railroad, so the two areas are considered as one district in this report. The production of the two counties in 1901 amounted to 8,036,292 short tons, as compared with 7,804,879 short tons in 1900.

The Pocahontas or Flat Top district embraces the counties of McDowell and Mercer in West Virginia, and Tazewell County in Virginia. The openings to the mines in Tazewell County are in Virginia, and it has been customary to credit that county and State with the total production, although it is known that most of the coal is taken from the West Virginia side of the line. Because of this the production of Tazewell County has been included in the following table with the Pocahontas or Flat Top district. The decreased production in Tazewell County in 1901, which was mentioned in connection with the discussion of Virginia's production, caused a falling off in the total output of the district for last year to 6,736,107 short tons, from 6,901,637 short tons in 1900.

The Fairmont region, which embraces Harrison and Marion counties, and includes the mines around Clarksburg and Fairmont, has shown the largest ratio of increase of all the coal-producing districts of West Virginia. The production of this district in 1901 was nearly thirteen times that of 1886, fifteen years before, four and one-half times that of 1891, and about three times that of 1896. As compared with 1900 it shows an increase of nearly 1,000,000 tons, not quite 25 per cent. The total product in 1901 amounted to 5,174,160 short tons, as compared with 4,187,630 tons in 1900.

The Upper Potomac or Elk Garden district is a part of an isolated basin which lies to the east of the main Appalachian field, and which includes the Cumberland region of Maryland, the Somerset district of Pennsylvania, and the Piedmont region of West Virginia. The counties in West Virginia included in this district are Mineral, Tucker, and Randolph. Most of the coal mined is drawn from what is known as "Big Vein," which has furnished the greater portion of Maryland's product. The production in 1901 was slightly less than that of the preceding year, being 1,856,677 short tons, as compared with 1,999,797 short tons in 1900. The production of the four principal districts of West Virginia since 1886 is shown in the following table:

Coal production of the principal districts of West Virginia since 1886.

[Short tons.]

Year.	New and Kanawha River district.	Pocahontas or Flat Top district.	Fairmont or Upper Monongahela district.	Upper Potomac or Elk Garden district.
1886	2,290,563	968,484	406,976	383,712
1887	2,379,296	1,357,040	520,064	503,343
1888	2,840,630	1,912,695	473,489	518,878
1889	2,669,016	2,290,270	456,582	666,956
1890	3,012,414	2,702,092	600,131	819,062
1891	3,632,209	3,137,012	1,150,569	1,052,308
1892	3,773,021	3,503,260	1,141,430	942,154
1893	4,099,112	3,815,280	1,255,956	1,129,397
1894	3,650,971	5,059,025	1,655,532	927,220
1895	4,399,623	4,044,998	1,550,256	1,125,601
1896	4,650,455	4,608,113	1,743,590	1,245,012
1897	4,921,701	4,859,373	2,074,663	1,425,026
1898	5,947,272	5,521,160	2,525,294	1,531,562
1899	6,544,956	6,033,344	3,374,183	1,786,009
1900	7,804,879	6,901,637	4,187,630	1,999,797
1901	8,036,292	6,736,107	5,174,160	1,856,677

In order to show how steady the growth of the coal-mining industry of West Virginia has been during the last twenty-one years, the following table has been prepared, which shows the increases each year since 1880. There has been only one break in the series, and the average annual increase for twenty-one years has exceeded 1,000,000 tons.

Annual increase in the coal production of West Virginia since 1880.

[Short tons.]

Year.	Quantity.	Year.	Quantity.
1881 over 1880	112,000	1894 over 1893	919,179
1882 over 1881	560,000	Total increase in fourteen years.	10,059,757
1883 over 1882	95,833	Decrease in 1895	239,796
1884 over 1883	1,024,167	Total increase in fifteen years.	9,819,961
1885 over 1884	9,062	1896 over 1895	1,488,335
1886 over 1885	636,734	1897 over 1896	1,371,863
1887 over 1886	875,824	1898 over 1897	2,452,840
1888 over 1887	617,180	1899 over 1898	2,551,996
1889 over 1888	733,080	1900 over 1899	3,394,212
1890 over 1889	1,162,774	1901 over 1900	1,421,195
1891 over 1890	1,826,011	Total increase in twenty-one years	22,500,402
1892 over 1891	518,090	Average annual increase	1,071,448
1893 over 1892	969,823		

The annual production of coal in West Virginia is shown in the following table:

Coal production of West Virginia since 1873.

[Short tons.]

Year.	Quantity.	Year.	Quantity.
1873	672,000	1888	5,498,800
1874	1,120,000	1889	6,231,880
1875	1,120,000	1890	7,394,654
1876	896,000	1891	9,220,665
1877	1,120,000	1892	9,738,755
1878	1,120,000	1893	10,708,578
1879	1,400,000	1894	11,627,757
1880	1,568,000	1895	11,387,961
1881	1,680,000	1896	12,876,296
1882	2,240,000	1897	14,248,159
1883	2,335,833	1898	16,700,999
1884	3,360,000	1899	19,252,995
1885	3,369,062	1900	22,647,207
1886	4,005,796	1901	24,068,402
1887	4,881,620		

WYOMING.

Total production in 1901, 4,485,374 short tons; spot value, $6,060,462.

Wyoming ranks second among the coal-producing States in the Rocky Mountain region, and third among the States west of the Mississippi River. In 1900 its production exceeded for the first time in the history of the State a total of 4,000,000 tons, and the production of 1901 has exceeded that of 1900 by 470,772 short tons, or 11.7 per cent. The values remained fairly steady in 1901 as compared with 1900, the average price per ton being $1.35 as compared with $1.36.

The number of coal-mining machines in use in 1901 was 74, as compared with the same number in 1900, and 56 in 1899. The machine-mined product in 1901 amounted to 804,826 short tons, which is to be compared with 653,314 tons in 1900, and 693,712 tons in 1899.

The statistics of production for the past two years are shown in the following tables:

Coal production of Wyoming in 1900, by counties.

County.	Loaded at mines for shipment.	Sold to local trade and used by employees.	Used at mines for steam and heat.	Made into coke.	Total production.	Total value.	Average price per ton.	Average number of days active.	Average number of employees.
	Short tons.	*Short tons.*	*Short tons.*	*Short tons.*	*Short tons.*				
Carbon	497,596	3,703	29,360	....	530,659	$747,221	$1.41	263	663
Converse	41,980	1,500	5,750	....	49,230	83,821	1.70	227	76
Crook	21,233	278	528	....	22,039	44,580	2.02	303	71
Sweetwater	1,555,492	5,768	62,776	....	1,624,036	2,268,181	1.40	280	2,152
Uinta	1,103,721	12,018	30,690	....	1,146,429	1,375,374	1.20	232	1,619
Fremont	3,324	3,800	....	....	7,124	15,148	2.13	164	21
Johnson									
Natrona									
Sheridan	553,608	1,352	47,665	32,460	635,085	923,628	1.45	306	730
Weston									
Total	3,776,954	28,419	176,769	32,460	4,014,602	5,457,953	1.36	266	5,332

Coal production of Wyoming in 1901, by counties.

County.	Loaded at mines for shipment.	Sold to local trade and used by employees.	Used at mines for steam and heat.	Made into coke.	Total production.	Total value.	Average price per ton.	Average number of days active.	Average number of employees.
	Short tons.	*Short tons.*	*Short tons.*	*Short tons.*	*Short tons.*				
Carbon	507,343	2,863	20,420	....	530,626	$825,291	$1.56	253	635
Converse	52,639	581	5,970	....	59,190	118,380	2.00	235	85
Crook	11,102	56	....	....	11,158	21,263	1.91	309	12
Sweetwater	1,632,305	6,753	66,822	....	1,705,880	2,457,730	1.44	245	2,171
Uinta	1,371,809	14,916	52,422	....	1,439,147	1,635,251	1.14	223	1,326
Fremont	5,865	4,550	50	....	10,465	21,855	2.09	200	17
Johnson									
Natrona									
Sheridan	641,461	2,242	49,375	35,830	728,908	980,692	1.35	293	905
Weston									
Total	4,222,524	31,961	195,059	35,830	4,485,374	6,060,462	1.35	248	5,151

In the following table is shown the total production for the State each year since 1868:

Total annual production of coal in Wyoming since 1868.

Year.	Quantity.	Value.	Year.	Quantity.	Value.
	Short tons.			*Short tons.*	
1868	6,925	....	1885	807,328	$2,421,984
1869	49,382	....	1886	829,355	2,488,065
1870	105,295	....	1887	1,170,318	3,510,954
1871	147,328	....	1888	1,481,540	4,444,620
1872	221,745	....	1889	1,388,947	1,748,617
1873	259,700	....	1890	1,870,366	3,183,669
1874	219,061	....	1891	2,327,841	3,555,275
1875	300,808	....	1892	2,503,839	3,168,776
1876	334,550	....	1893	2,439,311	3,290,904
1877	342,853	....	1894	2,417,463	3,170,392
1878	333,200	....	1895	2,246,911	2,977,901
1879	400,991	....	1896	2,229,624	2,904,185
1880	527,811	....	1897	2,597,886	3,136,694
1881	628,181	....	1898	2,863,812	3,664,190
1882	707,764	....	1899	3,837,392	4,742,525
1883	779,689	....	1900	4,014,602	5,457,953
1884	902,620	....	1901	4,485,374	6,060,462

The distribution of the product since 1889 has been as follows:

Distribution of the coal product of Wyoming from 1889 to 1901, inclusive.

Year.	Loaded at mines for shipment.	Sold to local trade and used by employees.	Used at mines for steam and heat.	Made into coke.	Total product.	Total value.	Average price per ton.	Average number of days active.	Average number of employees.
	Short tons.	*Short tons.*	*Short tons.*	*Short tons.*	*Short tons.*				
1889	1,354,443	15,433	19,071	....	1,388,947	$1,748,617	......	....	2,675
1890	1,835,299	28,540	6,527	....	1,870,366	3,183,669	....	246	3,272
1891	2,229,401	33,558	60,392	4,490	2,327,841	3,555,275	$1.53	....	3,411
1892	2,378,657	27,054	96,128	2,000	2,503,839	3,168,776	1.27	225	3,133
1893	2,280,685	64,188	87,086	7,352	2,439,311	3,290,904	1.35	189	3,378
1894	2,309,934	21,482	72,362	13,685	2,417,463	3,170,392	1.31	190	3,032
1895	2,106,937	35,628	81,065	23,281	2,246,911	2,977,901	1.33	184	3,449
1896	2,102,468	17,867	68,251	41,038	2,229,624	2,904,185	1.30	209	2,949
1897	2,435,091	17,845	93,974	50,976	2,597,886	3,136,694	1.21	219	3,137
1898	2,698,326	21,655	108,447	35,384	2,863,812	3,664,190	1.28	242	3,475
1899	3,584,667	32,429	188,196	32,100	3,837,392	4,742,525	1.24	261	4,697
1900	3,776,954	28,419	176,769	32,460	4,014,602	5,457,953	1.36	266	5,332
1901	4,222,524	31,961	195,059	35,830	4,485,374	6,060,462	1.35	248	5,151

COKE.

By Edward W. Parker.

INTRODUCTION.

In the report presented herewith, as in those which have preceded it, the use of the word "coke" is limited to the product which is obtained from the distillation or partial combustion of bituminous coal, either in retorts or in ovens, and which is generally known as "oven coke." What is known as "gas-house coke," which is a by-product in the manufacture of illuminating gas, is not considered in this report. During the last few years, however, on account of the development of coke manufacture in retort or by-product ovens, it has been necessary to include, in some instances, a certain amount of coke which has not been obtained as a primary product. The determination whether or not coke or gas is the primary product depends somewhat upon the location of the plant. Until 1893 practically all the coke made in the United States was the product of beehive ovens. A few experimental plants of Coppée, Thomas, and Welch, and other innovations, were constructed, but they did not prove successful in competition with the beehive style of oven. Since 1893, however, there has been a decided advance in the use of retort ovens with the recovery of by-products, and it is necessary to include the product of these ovens in this report. The coke obtained from them, whether it be a primary or a secondary product, is suitable for metallurgical purposes, and becomes a direct competitor with beehive coke; and, although a considerable quantity of the coke made in these by-product ovens is consumed for domestic or manufacturing purposes (and sometimes for locomotive use), particularly if the plant is located in the vicinity of large cities, it is considered as coming within the scope of this investigation. Moreover, a large amount of beehive coke is now prepared especially for domestic purposes. The amount so consumed can not be separated, and it is not possible to restrict this report to the statistics of coke made for metallurgical purposes. The subject of by-product coke manufacture is considered separately in another part of this report.

The coal consumed in the manufacture of coke in the United States is drawn from all of the five leading bituminous coal fields, which are: (1) The Appalachian field, embracing the great coking coal regions of Pennsylvania, Virginia, West Virginia, Ohio, Georgia, Alabama, Tennessee, and eastern Kentucky; (2) the Central field, which includes the coal areas of Illinois, Indiana, and western Kentucky; (3) the Western field, embracing the States of Iowa, Kansas, Missouri, and Arkansas, and the Indian Territory; (4) the Rocky Mountain field, including Colorado, New Mexico, Utah, Montana, and Wyoming; (5) the Pacific Coast field, in which the only coking coals are found in the State of Washington.

A considerable amount of coke is made in States in which there are no coal fields, namely, Massachusetts, New York, and Wisconsin. In addition to these, other coking plants are under construction in Maryland and New Jersey, the coal for which will be drawn from other States. Michigan had 30 ovens completed and 45 were in course of construction at the close of 1901, all of which will be fed by Pennsylvania coal. With the exception of Wisconsin, all of the plants in States outside of the coking-coal producing States are by-product ovens.

The writer desires at the outset to make special acknowledgment of the services rendered by Miss Belle Hill, of Pittsburg, Pa., whose excellent work in the preparation of the tables has made his task much easier than it otherwise would have been. During the life of the late Joseph D. Weeks, Miss Hill was his principal assistant in the preparation of the tables for his reports on the production of coke, petroleum, and natural gas. Since his death the Geological Survey has continued to have the benefit of her ability and of the knowledge and experience acquired by her under Mr. Weeks, and they have been the chief factor in securing the accuracy and completeness of the present report. No revision or correction of the tables prepared by her has been found necessary.

The unit of measurement used in this chapter is uniformly the short ton of 2,000 pounds.

PRODUCTION.

Including the output from 1,165 retort or by-product ovens, the total coke production of the United States in 1901 amounted to 21,795,883 short tons, valued at $44,445,923, as compared with 20,533,348 short tons, valued at $47,443,331, in 1900, and 19,668,569 short tons, valued at $34,670,417, in 1899. The increase in production in 1901 as compared with the preceding year was 1,262,535 short tons, or 6.15 per cent. The value of the product, however, showed a decrease of $2,997,408, or 6.3 per cent.

Notwithstanding the fact that the extraordinary demand for coke, which developed in 1899 and continued through 1900, was maintained throughout 1901, the average price per ton showed a decline from $2.31 in 1900 to $2.04 in 1901. This decline in price was a natural one, as during the spring of 1900 the prices were abnormally high and raised the average for that year to a figure nearly 15 per cent higher than the average of any year since 1880. A decline in 1901 was to more normal figures, although the average for the year was higher than for twenty years, with the exception of 1900. Another cause of the decline in value in 1901 was the fact that the number of completed ovens increased from 58,484 in 1900 to 64,001 in 1901, and the producers were better able to supply the demand, and the increased facilities for transportation furnished by the railroads enabled them to market the product more readily.

We can take the Connellsville coke as a basis for comparison. During 1901 Connellsville furnace coke ranged from $1.75 to $2.25, the lower figure being quoted in January and February and the higher price in December, with a general advancing tendency throughout the year. In 1900, on the other hand, Connellsville furnace coke, which opened at from $2.75 to $3.50 in January, advanced to as high as $4.25 in March and April, large sales being made at these high prices. Prices then steadily declined until December, when they were quoted at $1.75 to $2.

The value and the average price for coke are in many cases arbitrarily fixed, as a number of the larger manufacturers operate blast furnaces in connection with their coal-mining and coke-making business, in which cases the coke product is sometimes charged against the other departments at cost and sometimes at a figure based upon the cost of mining the coal and making the coke, with a percentage of profit on these operations. The value is not regulated according to the market price of the product at that time. In other cases, when no value of the coke is given by the operator, this has been estimated upon the values given by others producing practically the same grades of coke in the immediate vicinity.

At the close of 1900 there were 5,804 new ovens in course of construction, of which 1,096 were by-product ovens. Only 80 of the latter, however, were completed during 1901, and the increased production last year was almost entirely from beehive ovens. At the close of 1901 there were 5,155 ovens in course of construction, of which 1,533, or 30 per cent were by-product ovens. The production of by-product coke increased from 1,075,727 short tons in 1900 to 1,179,900 short tons in 1901.

The number of coke-making establishments, as shown by the returns for 1900, was 396, which increased in 1901 to 423.

The details of the production of coke in 1900 and 1901 are presented, by States and Territories, in the following tables.

Manufacture of coke in the United States, by States and Territories, in 1900.

State or Territory.	Establishments.	Ovens.		Coal used.	Yield of coal in coke.	Coke produced.	Total value of coke.	Value of coke per ton.
		Built.	Building.					
				Short tons.	*Per ct.*	*Short tons.*		
Alabama	30	6,529	690	3,582,547	58.9	2,110,837	$5,629,423	$2.667
Colorado[a]	13	1,488	0	997,861	62	618,755	1,746,732	2.82
Georgia	2	480	0	140,988	52.4	73,928	210,646	2.849
Indian Territory	3	230	0	79,534	48	38,141	152,204	3.99
Kansas	9	91	0	10,303	57.7	5,948	14,985	2.52
Kentucky	5	458	3	190,268	50.2	95,532	235,505	2.465
Missouri	3	10	0	3,775	55.3	2,087	5,268	2.52
Montana	3	342	111	108,710	50.3	54,731	337,079	6.159
New Jersey	1	0	100	0	0	0	0	0
New Mexico	2	126	0	74,261	60.3	44,774	130,251	2.909
Ohio	8	369	50	115,269	62.5	72,116	194,042	2.69
Pennsylvania	177	32,548	2,310	20,239,966	66	13,357,295	29,692,258	2.22
Tennessee	14	2,107	340	854,789	55.6	475,432	1,269,555	2.67
Utah[b]	1	204	0	....	....	....	....	....
Virginia	7	2,331	300	1,083,827	63.2	685,156	1,464,556	2.137
Washington	2	90	0	54,310	61.5	33,387	160,165	4.797
West Virginia	106	10,249	1,306	3,868,840	60.9	2,358,499	4,746,633	2.01
Illinois	3	154	0	708,295	71.5	506,730	1,454,029	2.87
Indiana	1	54	0					
Massachusetts	1	400	0					
Michigan	1	0	30					
New York	2	30	564					
Wisconsin	1	120	0					
Wyoming	1	74	0					
Total	396	[c] 58,484	[d] 5,804	32,113,543	63.9	20,533,348	47,443,331	2.31

[a] Colorado includes production of Utah.

[b] Included with Colorado.

[c] Includes 345 Semet-Solvay, 680 Otto-Hoffman, and 60 Newton-Chambers by-product ovens.

[d] Includes 150 Semet-Solvay and 946 Otto-Hoffman by-product ovens.

Manufacture of coke in the United States, by States and Territories, in 1901.

State or Territory.	Establishments.	Ovens.		Coal used.	Yield of coal in coke.	Coke produced.	Total value of coke.	Value of coke per ton.
		Built.	Building.					
				Short tons.	*Per ct.*	*Short tons.*		
Alabama	31	7,136	535	3,849,908	55.8	2,148,911	$6,062,616	$2.82
Colorado[a]	15	2,060	1,203	1,148,901	58.4	671,303	1,626,279	2.42
Georgia	2	510	0	89,919	60.7	54,550	154,625	2.83
Indian Territory	3	230	0	74,746	50	37,374	154,834	4.14
Kansas	12	98	3	11,629	61.4	7,138	15,079	2.11
Kentucky	5	461	0	204,297	49	100,285	208,015	2.07
Maryland	1	0	200	....	....	....	....	....
Missouri	3	9	0	9,041	52.5	4,749	9,968	2.099
Montana	3	328	111	102,950	55.4	57,004	337,381	5.918
New Jersey	1	0	100	....	....	....	....	....
New Mexico	2	126	0	72,350	57.5	41,643	118,368	2.84
Ohio	8	419	0	162,624	66.9	108,774	299,430	2.75
Pennsylvania	188	34,906	832	21,736,467	66	14,355,917	27,066,361	1.885
Tennessee	14	2,135	258	739,246	54.6	404,017	952,782	2.358
Utah[b]	1	204	0	....	....	....	....	....
Virginia	7	2,775	0	1,400,231	64.7	907,130	1,483,670	1.635
Washington	4	148	100	78,393	62.7	49,197	239,028	4.858
West Virginia	112	11,594	1,204	3,734,076	61.1	2,283,700	4,110,011	1.80
Illinois	3	154	0	793,187	71.1	564,191	1,607,476	2.849
Indiana	1	54	0					
Massachusetts	1	400	0					
Michigan	2	30	45					
New York	2	30	564					
Wisconsin	1	120	0					
Wyoming	1	74	0					
Total	423	[c] 64,001	[d] 5,155	34,207,965	63.7	21,795,883	44,445,923	2.039

[a] Includes the production of Utah.

[b] Included with Colorado.

[c] Includes 375 Semet-Solvay, 730 Otto-Hoffman, and 60 Newton-Chambers ovens

[d] Includes 210 Semet-Solvay, 896 Otto-Hoffman, and 427 Schniewind ovens.

The States which showed the largest increases in production during 1901 were Pennsylvania, whose output increased 998,622 short tons, and Virginia, whose output gained 221,974 short tons. Other increases in production were unimportant. There were five States in which decreases were shown, the principal losses being sustained by West Virginia and Tennessee.

The increases and decreases in the several States during 1901, as compared with 1900, are shown in the table following.

Increases and decreases in coke production, by States, in 1901, as compared with 1900.

State or Territory.	Production.		Increase.		Decrease.	
	1900.	1901.	Quantity.	Per cent.	Quantity.	Per cent.
	Short tons.	*Short tons.*	*Short tons.*		*Short tons.*	
Alabama	2,110,837	2,148,911	38,074	1.8	....	....
Colorado [a]	618,755	671,303	52,548	8.5	....	....
Georgia	73,928	54,550	....	....	19,378	26.2
Indian Territory	38,141	37,374	....	....	767	2
Kansas	5,948	7,138	1,190	20	....	....
Kentucky	95,532	100,285	4,753	4.98	....	....
Missouri	2,087	4,749	2,662	127.5	....	....
Montana	54,731	57,004	2,273	4.15	....	....
New Mexico	44,774	41,643	....	....	3,131	6.99
Ohio	72,116	108,774	36,658	50.8	....	....
Pennsylvania	13,357,295	14,355,917	998,622	7.48	....	....
Tennessee	475,432	404,017	....	....	71,415	15
Virginia	685,156	907,130	221,974	32.4	....	....
Washington	33,387	49,197	15,810	47.3	....	....
West Virginia	2,358,499	2,283,700	....	....	74,799	3.17
Illinois Indiana Massachusetts Michigan New York Wisconsin Wyoming	506,730	564,191	57,461	11.34	....	....
Total	20,533,348	21,795,883	1,262,535	6.15	....	....

[a] Includes Utah.

Statistics of the manufacture of coke in the United States, 1880 to 1901, inclusive.

Year.	Establishments.	Ovens.		Coal used.	Coke produced.	Total value of coke at ovens.	Value of coke at ovens, per ton.	Yield of coal in coke.
		Built.	Building.					
				Short tons.	*Short tons.*			*Per ct.*
1880	186	12,372	1,159	5,237,741	3,338,300	$6,631,267	$1.99	63
1881	197	14,119	1,005	6,546,662	4,113,760	7,725,175	1.88	63
1882	215	16,356	712	7,577,648	4,793,321	8,462,167	1.77	63
1883	231	18,304	407	8,516,670	5,464,721	8,121,607	1.49	64
1884	250	19,557	812	7,951,974	4,873,805	7,242,878	1.49	61
1885	233	20,116	432	8,071,126	5,106,696	7,629,118	1.49	63
1886	222	22,597	4,154	10,688,972	6,845,369	11,153,366	1.63	64
1887	270	26,001	3,584	11,859,752	7,611,705	15,321,116	2.01	64
1888	261	30,059	2,587	12,945,350	8,540,030	12,445,963	1.46	66
1889	252	34,165	2,115	15,960,973	10,258,022	16,630,301	1.62	64
1890	253	37,158	1,547	18,005,209	11,508,021	23,215,302	2.02	64
1891	243	40,245	911	16,344,540	10,352,688	20,323,216	1.97	63
1892	261	42,002	1,893	18,813,337	12,010,829	23,536,141	1.96	64
1893	258	44,201	717	14,917,146	9,477,580	16,523,714	1.74	63.5
1894	260	44,772	591	[a] 14,348,750	9,203,632	[a] 12,328,856	1.34	64
1895	265	45,565	638	20,848,323	13,333,714	[b] 19,234,319	1.44	64
1896	341	46,944	383	18,694,422	11,788,773	21,660,729	1.837	63
1897	336	47,668	575	20,907,319	13,288,984	22,102,514	1.663	63.5
1898	341	48,383	1,048	25,249,570	16,047,209	25,586,699	1.594	63.6
1899	343	49,603	4,037	30,219,343	19,668,569	34,670,417	1.76	65.1
1900	396	58,484	5,804	32,113,543	20,533,348	47,443,331	2.31	63.9
1901	423	64,001	5,155	34,207,965	21,795,883	44,445,923	2.039	63.7

[a] Excluding New York. [b] Excluding New York and Texas.

NUMBER OF COKE WORKS IN UNITED STATES.

The total number of establishments manufacturing coke in the United States for each year since 1880 is shown in the following table, together with those reported for the census years ending June 30, 1850, 1860, 1870, and 1880. For the details in regard to the number of establishments in each State the reader is referred to the discussion of the production of coke by States in the subsequent part of this report.

Number of coke establishments in the United States since 1850.

Year.	Number.	Year.	Number.
1850 (census year)	4	1889, December 31	253
1860 (census year)	21	1890, December 31	253
1870 (census year)	25	1891, December 31	243
1880 (census year)	149	1892, December 31	261
1880, December 31	186	1893, December 31	258
1881, December 31	197	1894, December 31	260
1882, December 31	215	1895, December 31	265
1883, December 31	231	1896, December 31	341
1884, December 31	250	1897, December 31	336
1885, December 31	233	1898, December 31	341
1886, December 31	222	1899, December 31	343
1887, December 31	270	1900, December 31	396
1888, December 31	261	1901, December 31	423

The 423 establishments in existence on December 31, 1901, include 14 having a total of 2,185 ovens which did not begin operations until 1902. They also include 53 establishments, with a total of 2,605 ovens, which did not produce any coke in 1901, the plants being idle throughout the entire year.

In this report the word "establishment" is used to designate the number of banks of ovens which were in existence, whether operated or idle, and whether they reported from one central office or separately. Prior to 1896 it was customary to include under one establishment all the coke works reported from one general office, hence there is an apparently large increase in the number of establishments in 1896 as compared with the preceding years.

It is interesting to note the increase in the number of establishments as compared with the increase in production. During the calendar year 1880 there were 186 coke-making establishments in the United States, which produced a total of 3,338,300 short tons, an average of 17,948 tons for each establishment; in 1901 there were 423 establishments, which produced 21,795,883 short tons, an average of 51,527 short tons for each establishment, or nearly three times the average for each establishment in 1880. It should be stated, moreover, that the number of establishments in 1901 includes the 14 new establishments, having a total of 2,185 ovens, which did not begin operations until after the close of the year. During this period the number of establishments has increased 127 per cent, while the production has increased over 550 per cent.

The following tables show the number of coke ovens in existence in each State and Territory on December 31 of each year from 1897 to 1901, and the total number of ovens in existence at the end of each year since 1880. The increase in the number of ovens in the two years from 1899 to 1901 was considerably more than the entire increase from 1890 to 1899. The 64,000 ovens completed at the end of 1901 include 1,165 by product ovens.

Number of coke ovens in each State at the close of each year from 1897 to 1901, inclusive.

State or Territory.	1897.	1898.	1899.	1900.	1901.
Alabama	5,365	5,456	5,599	6,529	7,136
Colorado	1,273	1,253	1,243	1,488	2,060
Georgia	300	350	350	480	510
Illinois	126	126	130	154	154
Indiana	94	94	52	54	54
Indian Territory	130	130	130	230	230
Kansas	57	47	95	91	98
Kentucky	268	292	300	458	461
Massachusetts	....	....	400	400	400
Michigan	....	....	....	....	30
Missouri	15	8	12	10	9
Montana	303	318	303	342	328
New Mexico	126	126	126	126	126
New York	25	25	25	30	30
Ohio	433	441	385	369	419
Pennsylvania	26,910	27,157	27,591	32,548	34,906
Tennessee	1,948	1,949	2,040	2,107	2,135
Texas	20	0	0	0	0
Utah	104	104	104	204	204
Virginia	1,453	1,564	1,588	2,331	2,775
Washington	120	90	90	90	148
West Virginia	8,404	8,659	8,846	10,249	11,594
Wisconsin	120	120	120	120	120
Wyoming	74	74	74	74	74
Total	47,668	48,383	49,603	58,484	64,001

Number of coke ovens in the United States on December 31 of each year from 1880 to 1901, inclusive.

Year.	Number.	Year.	Number.	Year.	Number.
1880	12,372	1888	30,059	1896	46,944
1881	14,119	1889	34,165	1897	47,668
1882	16,356	1890	37,158	1898	48,383
1883	18,304	1891	40,057	1899	49,603
1884	19,557	1892	42,002	1900	58,484
1885	20,116	1893	44,201	1901	64,001
1886	22,597	1894	44,772		
1887	26,001	1895	45,565		

The above table shows that there were 64,001 ovens in existence at the close of 1901, but it does not mean that all of these were in active operation. Of the 423 establishments in existence on December 31, 14 did not begin operations until 1902, and 53 establishments, having a total of 2,605 ovens, were idle throughout 1901, leaving 356 establishments, with a total of 61,396 ovens, in active operation. It will be seen from this that practically all of the idle plants were of comparatively little importance, the 53 idle establishments having an average of 49 ovens each, while the 356 active ones averaged 172 ovens. There were only 8 of the idle establishments in 1901 having more than 100 ovens to each.

In this connection it is also interesting to note the increase in the productive capacity of the coke ovens in the United States. It is not possible to compare the number of ovens in active operation each year, and the averages must be based upon the number of ovens in existence on December 31, as shown by the tables presented in this report. In 1880 the number of ovens in existence was 12,372. The total coke production was 3,338,300 short tons, an average of 270 short tons of coke per oven. In 1890 the total number of ovens had increased to 37,158, and the coke production to 11,508,021 short tons, an average of 310 tons of coke per oven. In 1901 the number of active ovens was 61,396, which produced 21,795,883 short tons, an average of 355 tons per oven. The 1,165 by-product ovens in operation in 1901 averaged 1,013 tons of coke each.

The following table shows the number of ovens in course of construction at the end of each year since 1880. This table is not intended to represent the increase in new ovens from year to year, nor does it include the new ovens completed during any one year. It is intended merely to show the condition of the industry at the close of each calendar year, as represented by the plants under construction. It will be seen that on December 1, 1901, there were 5,155 ovens building, which, with one exception (1900), was the largest number reported as being under construction at the end of any year. Of the new ovens in course of construction on December 31 of last year, 1,533, or nearly 30 per cent, were by-product ovens:

Number of coke ovens building in the United States at the close of each year from 1880 to 1901, inclusive.

Year.	Ovens.	Year.	Ovens.	Year.	Ovens.
1880	1,159	1888	2,587	1896	383
1881	1,005	1889	2,115	1897	575
1882	712	1890	1,375	1898	1,048
1883	407	1891	911	1899	4,037
1884	812	1892	1,893	1900	5,804
1885	432	1893	717	1901	5,155
1886	4,154	1894	591		
1887	3,594	1895	638		

PRODUCTION IN PREVIOUS YEARS.

The statistics compiled and published by the Geological Survey during the last twenty-two years are the only reliable record of coke production in the United States. The census of 1850 showed that there were 4 establishments making coke in the United States in that year; the following census, 1860, reported 21 ovens; in 1870, 25 ovens were reported as in existence, but the statistics of production were not stated separately. In the calendar year 1880 the coke production of the United States amounted to 3,338,300 tons; in 1890, ten years later, it had increased to 11,508,021 tons; in 1900 it had grown to 20,533,348 tons, and in 1901 it reached the maximum production of 21,795,883 tons. This growth has been fairly regular. There were five years in the twenty-two in which the production was less than in the preceding year. The most noteworthy of these were the panic years of 1893 and 1894, when the production fell off from 12,010,829 short tons in 1892 to 9,477,580 in 1893, and to 9,203,932 in 1894. The industry recovered from this depression in 1895, during which year a production of 13,333,714 tons was obtained. This recovery was due to a short-lived boom in the iron and steel trade in the spring of 1895. It was followed by another year of depression in 1896, since which time the production has increased without interruption, and is shown, by States, in the following table:

Amount of coke produced in the United States from 1896 to 1901, inclusive, by States and Territories.

[Short tons.]

State or Territory.	1896.	1897.	1898.	1899.	1900.	1901.
Alabama	1,479,437	1,443,017	1,663,020	1,787,809	2,110,837	2,148,911
Colorado (a)	343,313	319,036	445,982	530,424	618,755	671,303
Georgia	53,673	33,000	49,529	50,907	73,928	54,550
Indian Territory	21,021	30,364	34,110	24,339	38,141	37,374
Kansas	4,785	6,181	4,180	14,476	5,948	7,138
Kentucky	27,107	32,117	22,242	81,095	95,532	100,285
Missouri	2,500	2,593	740	2,860	2,087	4,749
Montana	60,078	67,849	52,009	56,376	54,731	57,004
New Mexico	24,228	1,438	6,980	44,134	44,774	41,643
Ohio	80,868	95,087	85,535	83,878	72,116	108,774
Pennsylvania	[b] 7,356,502	[b] 8,966,924	[b] 10,715,302	[b] 13,577,870	13,357,295	14,355,917
Tennessee	339,202	368,769	394,545	435,308	475,432	404,017
Texas	....	394	....	....	....	....
Utah	20,447	23,617	28,826	(a)	(a)	(a)
Virginia	268,081	354,067	531,161	618,707	685,156	907,130
Washington	25,949	26,189	30,197	30,372	33,387	49,197
West Virginia	1,649,755	1,472,666	1,925,071	2,278,577	2,358,499	2,283,700
Illinois	2,600	1,549	2,325	2,370	506,730	564,191
Indiana	4,353	2,904	1,825			
Massachusetts	....	....	....	(c)		
Michigan	....	....	....	....		
New York	(c)	(c)	(c)	(c)		
Wisconsin	5,332	17,216	35,280	33,437		
Wyoming	19,542	24,007	18,350	15,630		
Total	11,788,773	13,288,984	16,047,209	19,668,569	20,533,348	21,795,883

[a] Colorado includes Utah.
[b] Includes production of New York, and of Massachusetts also in 1899.
[c] Included with Pennsylvania.

The annual production since 1880 has been as follows:

Amount of coke produced in the United States from 1880 to 1901, inclusive.

Year.	Quantity.	Year.	Quantity.	Year.	Quantity.
	Short tons.		*Short tons.*		*Short tons.*
1880	3,338,300	1888	8,540,030	1895	13,333,714
1881	4,113,760	1889	10,258,022	1896	11,788,773
1882	4,793,321	1890	11,508,021	1897	13,288,984
1883	5,464,721	1891	10,352,688	1898	16,047,209
1884	4,873,805	1892	12,010,829	1899	19,668,569
1885	5,106,696	1893	9,477,580	1900	20,533,348
1886	6,845,369	1894	9,203,632	1901	21,795,883
1887	7,611,705				

VALUE OF COKE PRODUCED.

As previously stated, the value of the coke production in 1900 reached abnormally high figures. This was due to a combination of circumstances which has already been explained. During 1901 the prices returned to a more normal condition, with the result that the total value as compared with that of the preceding year shows a decrease of a little over $3,000,000. As compared with 1899, however, the value of the product last year shows an increase comparable with the increase in production during the two years, and with the general advance in values. As compared with 1899 the production increased 2,127,314 short tons, or somewhat over 10 per cent. The value of the product in 1901 exceeded that of 1899 by $9,775,506, or about 28 per cent.

The following tables show the value of the coke produced in each State and Territory during the last six years and the value of the total product for each year since 1880:

Total value, at the ovens, of the coke made in the United States from 1896 to 1901, inclusive, by States and Territories.

State or Territory.	1896.	1897.	1898.	1899.	1900.	1901.
Alabama	$3,064,960	$3,094,461	$3,378,946	$3,634,471	$5,629,423	$6,062,616
Colorado	[a]1,046,306	[a]999,216	[a]1,230,428	[a]1,333,769	[a]1,746,732	[a]1,626,279
Georgia	68,486	42,240	77,230	116,917	210,646	154,625
Indian Territory	73,574	104,725	96,639	71,965	152,204	154,834
Kansas	8,676	9,272	6,455	30,817	14,985	15,079
Kentucky	42,062	45,454	32,213	161,451	235,505	208,015
Missouri	4,131	3,890	1,050	5,520	5,268	9,968
Montana	425,483	467,481	359,174	356,190	337,079	337,381
New Mexico	48,453	3,232	14,625	99,217	130,251	118,368
Ohio	208,789	235,784	211,558	255,129	194,042	299,430
Pennsylvania	[b]13,182,859	[b]13,727,966	[b]16,078,505	[c]22,881,910	29,692,258	27,066,361
Tennessee	624,011	667,656	642,920	850,686	1,269,555	952,782
Utah	(*d*)	(*d*)	(*d*)	(*d*)	(*d*)	(*d*)

[a] Includes value of Utah coke.

[b] Includes value of New York coke.

[c] Includes Massachusetts and New York

[d] Included with Colorado.

Total value, at the ovens, of the coke made in the United States from 1896 to 1901, inclusive, by States and Territories—Continued.

State or Territory.	1896.	1897.	1898.	1899.	1900.	1901.
Virginia	$404,573	$495,864	$699,781	$1,071,284	$1,464,556	$1,483,670
Washington	104,894	115,754	128,933	151,216	160,165	239,028
West Virginia	2,259,999	1,933,808	2,432,657	3,480,408	4,746,633	4,110,011
Illinois	5,200	2,895	4,686	5,565	1,454,029	1,607,476
Indiana	8,647	5,795	3,194			
Massachusetts	....	....	....	(*a*)		
Michigan	....	....	....	....		
New York	(*a*)	(*a*)	(*a*)	(*a*)		
Wisconsin	21,000	75,000	123,480	125,389		
Wyoming	58,626	72,021	64,225	38,510		
Total	21,660,729	22,102,514	25,586,699.	34,670,417	47,443,331	44,445,923

[a] Included with Pennsylvania.

Total value, at the ovens, of the coke made in the United States from 1880 to 1901, inclusive.

Year.	Value.	Year.	Value.	Year.	Value.
1880	$6,631,265	1888	$12,445,963	1896	$21,660,729
1881	7,725,175	1889	16,630,301	1897	22,102,514
1882	8,462,167	1890	23,215,302	1898	25,586,699
1883	8,121,607	1891	20,393,216	1899	34,670,417
1884	7,242,878	1892	23,536,141	1900	47,443,331
1885	7,629,118	1893	16,523,714	1901	44,445,923
1886	11,153,366	1894	12,328,856		
1887	15,321,116	1895	19,234,319		

From the preceding statements, showing the amount and value of the coke produced in a series of years, the following tables have been prepared. These show the average price per ton obtained for the coke product in each State and Territory for the last six years, and the average price of the total product since 1880. These average prices are obtained by dividing the total value by the total amount of coke produced or sold. Although the figures may be accepted as indicating the general tendency of prices, they do not always represent the actual selling value of the coke, as has already been shown. Some of the largest producers of coke consume their entire product in their own blast furnaces. In some such cases the value of the coke is given at the actual cost of production; in others it is based upon the cost of production, adding a percentage of profit on the coking operations; and in still other cases the values are based upon the marketed product for a similar quality of coke in the immediate vicinity. These conditions, however, continue without material change from year to year, so that the prices as given may be generally accepted as indicating the general condition of the market. The highest average price for coke obtained for the period under review was in 1900, when an average for all qualities and in all States reached as high as $2.31, an increase of 55 cents, or more than 30 per cent, over that of 1899. This was due to an almost panicky demand for coke, which prevailed during the spring of 1900, and which was rendered more acute by the inability of railroads to supply the rolling stock necessary to handle and market the product. A more rational condition of affairs existed during the latter part of 1900 and throughout 1901. The average price for last year was $2.039, a decrease of about 27 cents, or about 12 per cent, from 1900, but, with the exception of 1900, the highest figure quoted during the last twenty-two years. Prior to 1900 the highest average obtained was in 1890, when it reached $2.02.

Average value per short ton at the ovens of the coke made in the United States from 1896 to 1901, inclusive, by States and Territories.

State or Territory.	1896.	1897.	1898.	1899.	1900.	1901.
Alabama	$2.07	$2.14	$2.03	$2.03	$2.667	$2.82
Colorado	[a]2.88	[a]2.916	[a]2.59	[a]2.51	[a]2.82	[a]2.42
Georgia	1.276	1.28	1.56	2.30	2.849	2.83
Indian Territory	3.50	3.45	2.833	2.96	3.99	4.11
Kansas	1.813	1.50	1.544	2.13	2.52	2.11
Kentucky	1.55	1.41	1.448	1.99	2.465	2.07
Missouri	1.65	1.50	1.42	1.93	2.52	2.099
Montana	7.08	6.89	6.906	6.32	6.159	5.918
New Mexico	2.00	2.25	2.095	2.25	2.909	2.84
Ohio	2.58	2.48	2.47	3.04	2.69	2.75
Pennsylvania	[b]1.792	[b]1.53	[b]1.50	[b]1.69	2.22	1.885
Tennessee	1.84	1.81	1.63	1.95	2.67	2.358
Utah [c]	....	....	....	....	....	....
Virginia	1.509	1.40	1.317	1.73	2.137	1.635
Washington	4.04	4.42	4.27	4.98	4.797	4.858
West Virginia	1.37	1.31	1.26	1.53	2.01	1.80
Illinois	2.00	1.87	2.02	2.35	2.87	2.849
Indiana	1.99	1.995	1.75			
Massachusetts	....	....	....	(d)		
Michigan	....	....	....	....		
New York	(d)	(d)	(d)	(d)		
Wisconsin	3.94	4.36	3.50	3.75		
Wyoming	3.00	3.00	3.50	2.46		
Average	1.837	1.663	1.594	1.76	2.31	2.039

[a] Includes Utah.

[b] Average value, including New York, and Massachusetts also in 1899.

[c] Included with Colorado.

[d] Included with Pennsylvania.

Average value per short ton at the ovens of the coke made in the United States from 1880 to 1901, inclusive.

Year.	Value.	Year.	Value.	Year.	Value.
1880	$1.99	1888	$1.46	1896	$1.837
1881	1.88	1889	1.62	1897	1.663
1882	1.77	1890	2.02	1898	1.594
1883	1.49	1891	1.97	1899	1.76
1884	1.49	1892	1.96	1900	2.31
1885	1.49	1893	1.74	1901	2.039
1886	1.63	1894	1.34		
1887	2.01	1895	1.44		

RANK OF COKE-PRODUCING STATES.

The following table gives the relative rank of the States and Territories in production of coke from 1880 to 1901, inclusive:

Rank of the States and Territories in production of coke from 1880 to 1901, inclusive.

State or Territory.	1880.	1881.	1882.	1883.	1884.	1885.	1886.	1887.	1888.	1889.	1890.
Pennsylvania	1	1	1	1	1	1	1	1	1	1	1
West Virginia	2	2	2	2	3	3	4	2	2	3	3
Alabama	5	5	4	3	2	2	2	4	3	2	2
Colorado	7	6	6	5	5	5	5	5	5	5	6
Tennessee	3	3	3	4	4	4	3	3	4	4	5
Virginia	......	......	......	8	7	7	6	6	6	6	4
Ohio	4	4	5	6	8	8	8	7	8	8	8
Montana	......	......	......	......	15	15	......	16	12	10	11
Georgia	6	7	7	7	6	6	7	8	7	7	10
Kentucky	9	10	10	11	12	13	14	12	9	12	7
Washington	......	......	......	......	14	14	15	11	10	17	13
New Mexico	......	......	12	12	9	9	10	13	14	18	9
Indian Territory	11	11	11	13	13	12	12	14	15	15	17
Utah	12	......	13	......	......	......	......	......	......	19	19
Wisconsin	......	......	......	......	......	......	......	......	18	9	14
Kansas	10	9	9	10	11	11	9	10	11	11	12
Indiana	......	......	......	......	......	......	13	9	13	14	15
Illinois	8	8	8	9	10	10	11	15	16	13	18
Missouri	......	......	......	......	......	......	......	17	17	16	16
Texas	......	......	......	......	......	......	......	......	....	......	......

State or Territory.	1891.	1892.	1893.	1894.	1895.	1896.	1897.	1898.	1899.	1900.	1901.
Pennsylvania	1	1	1	1	1	1	1	1	1	1	1
West Virginia	3	3	3	2	3	2	2	2	2	2	2
Alabama	2	2	2	3	2	3	3	3	3	3	3
Virginia	6	6	6	6	6	6	5	4	4	4	4
Colorado	5	4	4	4	5	4	6	5	5	5	5
Massachusetts	......	......	......	......	......	......	......	......	7	7	6
Tennessee	4	5	5	5	4	5	4	6	6	6	7
Ohio	8	8	10	8	8	7	7	7	8	10	8
Kentucky	10	9	8	9	9	10	10	15	9	8	9
Montana	11	10	9	10	10	8	8	8	10	11	10
Georgia	7	7	7	7	7	9	9	9	11	9	11
Utah	14	13	11	12	11	14	15	13	16	15	12
Wisconsin	9	11	12	18	17	17	16	10	13	12	13
Washington	16	15	16	16	13	11	13	12	14	17	14
New Mexico	20	......	18	15	14	12	21	17	12	13	15
New York	......	......	13	11	12	16	12	14	15	16	16
Indian Territory	13	16	15	19	16	13	11	11	17	14	17
Wyoming	19	......	20	17	18	15	14	16	18	18	18
Kansas	12	12	14	13	15	18	17	18	19	19	19
Michigan	......	......	......	......	......	......	......	......	......	......	20
Missouri	15	14	17	20	21	21	19	21	20	20	21
Illinois	17	18	21	21	20	20	20	19	22	22	22
Indiana	18	17	19	14	19	19	18	20	21	21	......
Texas	......	......	......	......	22	22	22	......	......	......	......

COAL CONSUMED IN MANUFACTURE OF COKE.

A large amount of coal consumed in the manufacture of coke in the United States is charged directly from the mines, as run-of-mine coal, into the ovens. The only method of determining the amount so used is according to the price paid for mining the coal, which may be by the measured bushel or ton, or by the contents of the pit car, all of which are apt to differ materially from that of the weighed ton or bushel. There are apparently few establishments in this country where the weight of the coal is accurately determined before being charged into the ovens, although, as the industry becomes better organized, more attention is being paid to the accurate determination of results. It is still necessary, however, to estimate largely upon the amount of coal consumed in the consumption of coke. A considerable quantity of the coal used is washed before being charged into the ovens. In some such cases the weight of the coal before washing is given approximately. In other cases the weight, after slate and other impurities have been largely removed, is reported for the weight of the coal charged into the ovens. In a number of instances the coke ovens have been constructed for the purpose of utilizing the slack, which would otherwise be entirely a wasted product, and when such a condition obtains no account whatsoever is taken of the weight of the coal. It can be readily seen, therefore, that any statement as to the amount of coal used in the manufacture of coke is necessarily only approximate, but as these differences appear from year to year they may be accepted as sufficiently accurate as a basis of comparison.

It may be well to repeat in this connection what has been stated in previous reports, that an apparent discrepancy exists between the statements regarding the amount of coal consumed in the manufacture of coke, made in the reports on coal production and in the chapters on coke manufacture. Such discrepancies are usually due to the fact that a large amount of coal is shipped to coke ovens at a distance from the mines. In such cases the coal would appear in the report on coal production in the shipments of coal to market, while in the coke report it would appear as coal made into coke. In the report on the production of coal, the coal made into coke includes only that which is consumed at or in the immediate vicinity of the mines, and not reported as coal shipped.

Amount of coal used in the manufacture of coke in the United States from 1896 to 1901, inclusive, by States and Territories.

[Short tons.]

State or Territory.	1896.	1897.	1898.	1899.	1900.	1901.
Alabama	2,573,713	2,451,475	2,814,615	3,028,472	3,582,547	3,849,908
Colorado	[a] 639,238	[a] 616,592	[a] 803,686	[a] 898,207	[a] 997,861	[a] 1,148,901
Georgia	109,655	67,000	81,108	78,098	140,988	89,919
Indian Territory	53,028	68,495	73,330	59,255	79,534	74,746
Kansas	8,940	11,772	7,856	26,988	10,303	11,629
Kentucky	55,719	64,234	44,484	151,503	190,268	204,297
Missouri	4,471	4,627	1,500	5,320	3,775	9,041
Montana	113,165	139,907	92,552	110,274	108,710	102,950
New Mexico	39,286	2,585	12,557	68,594	74,261	72,350
Ohio	128,923	151,545	134,757	142,678	115,269	162,624
Pennsylvania	[c] 11,124,610	[c] 13,538,646	[c] 16,307,841	[d] 19,930,419	20,239,966	21,736,467
Tennessee	600,379	667,996	722,356	779,995	854,789	739,246
Texas	0	700	0	0	0	0
Utah	(e)	(e)	(e)	(e)	(e)	(e)
Virginia	454,964	574,542	852,972	994,635	1,083,827	1,400,231
Washington	38,685	39,124	48,559	50,813	54,310	78,393
West Virginia	2,687,104	2,413,283	3,145,398	3,802,825	3,868,840	3,734,076
Illinois	3,900	3,591	6,650	4,217	708,295	793,187
Indiana	8,956	7,022	4,065			
Massachusetts	....	....	....	(b)		
Michigan	....	....	....	....		
New York	(b)	(b)	(b)	(b)		
Wisconsin	8,648	29,207	59,900	54,950		
Wyoming	41,038	54,976	35,384	32,100		
Total	18,694,422	20,907,319	25,249,570	30,219,343	32,113,543	34,207,965

[a] Includes coal coked in Utah.

[b] Included with Pennsylvania.

[c] Includes New York.

[d] Includes Massachusetts and New York.

[e] Included with Colorado.

Amount of coal used in the manufacture of coke in the United States from 1880 to 1901, inclusive, by States and Territories.

Year.	Short tons.	Year.	Short tons.	Year.	Short tons.
1880	5,237,741	1888	12,945,350	1895	20,848,323
1881	6,546,762	1889	15,960,973	1896	18,694,422
1882	7,577,646	1890	18,005,209	1897	20,907,319
1883	8,516,670	1891	16,344,540	1898	25,249,570
1884	7,951,974	1892	18,813,337	1899	30,219,343
1885	8,071,126	1893	14,917,146	1900	32,113,543
1886	10,688,972	1894	14,348,750	1901	34,207,965
1887	11,859,752				

AMOUNT AND VALUE OF COAL USED IN COKE MAKING.

The amount and value of coal used in the manufacture of coke in 1900 and 1901, together with the amount and value of coal used per ton of coke, are shown, by States and Territories, in the following tables.

The amount of coal used in 1901 was 34,207,965 short tons, as compared with 32,113,543 short tons in 1900, an increase of 2,094,422 short tons. The value of this coal increased from $28,134,756 in 1900 to $31,378,631 in 1901, a gain of $3,243,875. From this it will be seen that the cost to the coke producers of the coal used increased over $3,000,000, while the value of the resulting coke decreased about the same amount.

Amount and value of coal used in the manufacture of coke in the United States in 1900, and amount and value of same per ton of coke.

State or Territory.	Coal used.	Total value of coal.	Value of coal per ton.	Amount of coal per ton of coke.	Value of coal to a ton of coke.
	Short tons.			*Short tons.*	
Alabama	3,582,547	$3,968,305	$1.108	1.697	$1.88
Colorado[a]	997,861	714,737	.717	1.612	1.156
Georgia	140,988	89,734	.636	1.907	1.213
Indian Territory	79,534	49,147	.618	2.085	1.288
Kansas	10,303	9,889	.96	1.732	1.663
Kentucky	190,268	115,497	.607	2.00	1.214
Missouri	3,775	1,996	.529	1.809	.957
Montana	108,710	249,133	2.29	1.99	4.557
New Mexico	74,261	47,307	.637	1.66	1.057
Ohio	115,269	133,347	1.157	1.598	1.849
Pennsylvania	20,239,966	17,146,093	.847	1.515	1.283
Tennessee	854,789	867,089	1.014	1.798	1.823
Utah	....	....	....	....	....
Virginia	1,083,827	914,310	.844	1.582	1.335
Washington	54,310	100,319	1.847	1.626	3.003
West Virginia	3,868,840	2,622,485	.678	1.64	1.112
Illinois	708,295	1,104,368	1.559	1.398	2.179
Indiana					
Massachusetts					
New York					
Wisconsin					
Wyoming					
Total	32,113,543	28,134,756	.876	1.57	1.375

[a] Includes Utah.

Amount and value of coal used in the manufacture of coke in the United States in 1901, and amount and value of same per ton of coke.

State or Territory.	Coal used.	Total value of coal.	Value of coal per ton.	Amount of coal per ton of coke.	Value of coal to a ton of coke.
	Short tons.			*Short tons.*	
Alabama	3,849,908	$4,362,240	$1.133	1.79	$2.03
Colorado (*a*)	1,148,901	734,356	.639	1.71	1.093
Georgia	89,919	53,951	.60	1.648	.989
Indian Territory	74,746	60,997	.816	2.00	1.632
Kansas	11,629	10,594	.91	1.629	1.484
Kentucky	204,297	89,647	.439	2.037	.894
Missouri	9,041	5,398	.597	1.90	1.136
Montana	102,950	281,124	2.73	1.806	4.93
New Mexico	72,350	40,635	.56	1.737	.975
Ohio	162,624	236,744	1.455	1.495	2.176
Pennsylvania	21,736,467	19,654,216	.904	1.514	1.369
Tennessee	739,246	753,258	1.019	1.83	1.864
Utah	....	....	....	....	....
Virginia	1,400,231	913,073	.652	1.543	1.006
Washington	78,393	145,197	1.85	1.59	2.95
West Virginia	3,734,076	2,748,643	.736	1.635	1.203
Illinois Massachusetts Michigan New York Wisconsin Wyoming	793,187	1,288,558	1.625	1.406	2.284
Total	34,207,965	31,378,631	.917	1.57	1.44

a Includes Utah.

The following table shows approximately the amount of coal required to produce a ton of coke in each year since 1880:

Coal required to produce a ton of coke, in tons or pounds.

Year.	Tons.	Pounds.	Year.	Tons.	Pounds.
1880	1.57	3,140	1891	1.58	3,160
1881	1.59	3,180	1892	1.57	3,140
1882	1.58	3,160	1893	1.57	3,140
1883	1.56	3,120	1894	1.56	3,120
1884	1.63	3,260	1895	1.56	3,120
1885	1.58	3,160	1896	1.58½	3,170
1886	1.56	3,120	1897	1.57	3,140
1887	1.56	3,120	1898	1.57	3,140
1888	1.51	3,020	1899	1.54	3,080
1889	1.55	3,100	1900	1.57	3,140
1890	1.56	3,120	1901	1.57	3,140

YIELD OF COAL IN COKE.

By the yield of coal in coke is meant the percentage by weight of the constituents of the coal that remains as coke after the process of coking is completed. The following table shows that the general average yield of coal in coke is about 64 per cent, but this is believed to be somewhat excessive. For the reasons stated in connection with the amount of coal made into coke, it is not always possible to obtain exact information on this point, as in many instances the coal is not weighed before being charged into the ovens, and the amount consumed is largely an estimate. It is doubtful if the average yield of coal in coke throughout the United States exceeds 60 per cent.

Percentage yield of coal in coke for the years 1880 to 1901, inclusive.

Year.	Percentage yield of coal.	Year.	Percentage yield of coal.	Year.	Percentage yield of coal.
1880	63	1888	66	1896	63
1881	63	1889	64	1897	63.5
1882	63	1890	64	1898	63.6
1883	64	1891	63	1899	65.1
1884	61	1892	64	1900	63.9
1885	63	1893	63.5	1901	63.7
1886	64	1894	64		
1887	64.2	1895	64		

The following table shows the percentage yield of coal in coke in each State during the last six years:

Percentage yield of coal in coke, 1896 to 1901, inclusive, by States.

State or Territory.	1896.	1897.	1898.	1899.	1900.	1901.
Alabama	57.5	58.8	59	59	58.9	55.8
Colorado [a]	56.9	55.6	59.1	59	62	58.4
Georgia	49	49.3	61	65.2	52.4	60.7
Indian Territory	40	44.3	46.5	41	48	50
Kansas	53.5	52.5	53	53.6	57.7	61.4
Kentucky	48.6	50	50	53.5	50.2	49
Missouri	55.9	56	49.3	53.8	55.3	52.5
Montana	53	48.5	56	51	50.3	55.4
New Mexico	61.7	55.6	55.6	64.3	60.3	57.5
Ohio	62.7	62.7	63.5	58.8	62.5	66.9
Pennsylvania	[b] 66.1	[b] 66.2	[b] 65.7	[b] 68.1	66	66
Tennessee	56.5	55	54.6	55.8	55.6	54.6
Texas	0	56.3	0	0	0	0
Utah						
Virginia	58.9	61.6	62	62.2	63.2	64.7
Washington	67	67	62.2	59.8	61.5	62.7
West Virginia	61.4	61	61.2	60	60.9	61.1
Illinois	66.7	43	35	56.2	71.5	71.1
Indiana	49	41.4	44.9			
Massachusetts						
Michigan						
New York						
Wisconsin	62	59	59	60.8		
Wyoming	47.6	43.7	51.9	48.7		
Total average	63	63.5	63.6	65.1	63.9	63.7

[a] Average, including Utah.

[b] Average, including New York, also Massachusetts for 1899.

CONDITION IN WHICH COAL IS CHARGED INTO OVENS.

In the following table will be found a statement of the condition in which the coal was charged into the ovens in the several States and Territories during the last two years, and a résumé of the corresponding statistics for the last twelve years during which these statistics have been compiled. In a number of the coal-producing States it has been found that a washing of the coal before charging it into the ovens has materially improved the quality of the coke. This has been particularly true in regard to the slack coal used. Most of the run-of-mine coal which is washed before coking is crushed before being washed, in order to effect a more complete separation of the slate, pyrite, and other impurities which exist in the coal.

The principal increase in the production of coke in 1901 was in the State of Pennsylvania, in which by far the larger proportion of the coal used is unwashed run-of-mine. In 1901 the amount of the unwashed run-of-mine coal used in Pennsylvania exceeded that of the preceding year by about 2,000,000 tons. The amount of washed run-of-mine used in this State was about the same in both years. The amount of unwashed slacked coal used in Pennsylvania decreased over 400,000 tons, and the amount of washed slack fell off about 100,000 tons. In Alabama, however, the washed run-of-mine coal used in 1901 was more than three times that of the preceding year, while the washed slack increased 163,814 tons, or a little over 10 per cent. The amount of coal unwashed, both run-of-mine and slack, used in Alabama during 1901 was less than in the preceding year. In Virginia all of the coal used is unwashed; about 60 per cent of this is run-of-mine and 40 per cent slack. West Virginia coke producers depend principally upon slack coal for their ovens, about 80 per cent of the coal used in this State being of this nature. Most of it is unwashed, as it is fairly free from injurious impurities. In Colorado the tendency to wash the coal before coking, particularly slack, shows a decided increase, and there is a corresponding falling off in the amount of unwashed slack consumed.

The amount of unwashed run-of-mine coal used increased from 21,062,090 short tons in 1900 to 23,751,468 short tons in 1901. The washed run-of-mine increased from 1,369,698 short tons in 1900 to 1,600,714 short tons in 1901. The use of unwashed slack fell off over 1,130,000 tons, from 5,677,006 short tons to 4,546,201 short tons; while the washed slack increased from 4,004,749 short tons to 4,309,582 short tons. Since 1890 the percentage of the washed coal used has nearly trebled. In the former year the amount of washed coal used was equivalent to about 7 per cent of the total, while in 1901 the washed coal represented 17.6 per cent of all the coal consumed.

Character of coal used in the manufacture of coke in 1900.

[Short tons.]

State or Territory.	Run of mine.		Slack.		Total.
	Unwashed.	Washed.	Unwashed.	Washed.	
Alabama	1,729,882	152,077	165,418	1,535,170	3,582,547
Colorado[a]	229,311	0	316,527	452,023	997,861
Georgia	0	68,988	0	72,000	140,988
Indian Territory	0	0	20,832	58,702	79,534
Kansas	0	3,786	6,517	0	10,303
Kentucky	6,043	17,717	78,583	87,925	190,268
Missouri	0	0	2,680	1,095	3,775
Montana	0	74,475	0	34,235	108,710
New Mexico	10,611	0	27,604	36,046	74,261
Ohio	68,175	0	17,094	30,000	115,269
Pennsylvania	17,692,623	647,045	1,300,796	599,502	20,239,966
Tennessee	150,697	349,448	24,122	330,522	854,789
Utah	....	....	....	....	....
Virginia	620,207	0	463,620	0	1,083,827
Washington	0	48,162	0	6,148	54,310
West Virginia	509,960	8,000	3,140,064	210,816	3,868,840
Illinois	44,581	0	113,149	550,565	708,295
Indiana					
Massachusetts					
New York					
Wisconsin					
Wyoming					
Total	21,062,090	1,369,698	5,677,006	4,004,749	32,113,543

[a] Includes Utah.

Character of coal used in the manufacture of coke in 1901.

[Short tons.]

State or Territory.	Run of mine.		Slack.		Total.
	Unwashed.	Washed.	Unwashed.	Washed.	
Alabama	1,641,830	491,298	17,796	1,698,984	3,849,908
Colorado[a]	428,642	0	43,078	677,181	1,148,901
Georgia	0	0	10,574	79,345	89,919
Indian Territory	0	0	0	74,746	74,746
Kansas	0	3,839	4,140	3,650	11,629
Kentucky	0	28,000	67,311	108,986	204,297
Missouri	0	0	1,741	7,300	9,041
Montana	0	65,137	0	37,813	102,950
New Mexico	0	13,830	0	58,520	72,350
Ohio	100,345	0	42,279	20,000	162,624
Pennsylvania	19,689,162	647,209	893,476	506,620	21,736,467
Tennessee	224,723	282,129	34,088	198,306	739,246
Utah	....	....	....	....	....
Virginia	869,203	0	531,028	0	1,400,231
Washington	0	69,272	0	9,121	78,393
West Virginia	733,786	0	2,705,392	291,898	3,734,076
Illinois	63,777	0	195,298	534,112	793,187
Massachusetts					
Michigan					
New York					
Wisconsin					
Wyoming					
Total	23,751,468	1,600,714	4,546,201	4,309,582	34,207,965

[a] Includes Utah.

In the following table the statistics regarding the character of the coal for the years 1890 to 1901, inclusive, are consolidated:

Character of coal used in the manufacture of coke in the United States since 1890, inclusive.

[Short tons.]

Year.	Run of mine.		Slack.		Total.
	Unwashed.	Washed.	Unwashed.	Washed.	
1890	14,060,907	338,563	2,674,492	931,247	18,005,209
1891	12,255,415	290,807	2,945,359	852,959	16,344,540
1892	14,453,638	324,050	3,256,493	779,156	18,813,337
1893	10,306,082	350,112	3,049,075	1,211,877	14,917,146
1894	9,648,750	405,266	3,102,652	1,192,082	14,348,750
1895	15,609,875	237,468	3,052,246	1,948,734	20,848,323
1896	11,307,905	763,244	4,685,832	1,937,441	18,694,422
1897	13,234,985	1,037,830	4,180,575	2,453,929	20,907,319
1898	16,758,244	1,672,972	4,487,949	2,330,405	25,249,570
1899	20,870,915	1,457,961	4,976,737	2,913,730	30,219,343
1900	21,062,090	1,369,698	5,677,006	4,004,749	32,113,543
1901	23,751,468	1,600,714	4,546,201	4,309,582	34,207,965

COKE MAKING IN BY-PRODUCT OVENS.

In the report for 1900 it was stated that the development of the coke manufacture in retort ovens for that year was noticeable rather for the number of new plants and ovens in course of construction at the close of the year than for any increase in production or in actual number of ovens completed. The same statement is true in regard to this branch of the coke-making industry for last year. While there were 1,096 by-product ovens building at the close of 1900, only 80 were added to the completed ovens during 1901, increasing the total number of completed ovens from 1,085 to 1,165. The production of by-product coke increased from 1,075,727 short tons in 1900 to 1,179,900 short tons in 1901. The number of by-product ovens in course of construction on December 31, 1901, was 1,533, which included 1,011 ovens reported as in course of construction at the close of the preceding year, a net increase of 522 new ovens begun in 1901 and not completed during that year.

The average production of the 1,165 by-product ovens in 1901 was a little over 1,000 tons per oven. The production of all the other ovens averaged about 343 tons per oven, indicating that the capacity of the retort ovens is about three times that of the beehive ovens.

The first plant of by-product ovens constructed in the United States was erected at Syracuse, N. Y., by the Semet-Solvay Company in 1893. It was an experimental plant of 12 ovens, operated in connection with the chemical works of the Solvay Process Company in that city. This plant has since been enlarged to a total of 30 ovens. The first Otto-Hoffman ovens were begun at Johnstown, Pa., in 1897 and completed in 1898. Sixty Newton-Chambers ovens were constructed at Latrobe, Pa., about the same time, but did not prove satisfactory. The plant was dismantled at Latrobe and another constructed at Pocahontas, Va., in 1900, where it has been operated with more success.

Reduced to tabular form the record of by-product coke making in the United States since 1893, when the first plant was constructed at Syracuse, has been as follows:

Record of by-product coke making since 1893.

Year.	Ovens.		Product.
	Built.	Building.	
			Short tons.
1893	12	0	12,850
1894	12	60	16,500
1895	[a] 72	60	18,521
1896	160	120	83,038
1897	280	240	261,912
1898	[b] 520	[c] 500	294,445
1899	[d] 1,020	[e] 65	906,534
1900	[f] 1,085	[g] 1,096	1,075,727
1901	[h] 1,165	[i] 1,533	1,179,900

[a] Sixty of these ovens did not begin making coke until 1896.

[b] Includes 280 Semet-Solvay, 180 Otto-Hoffman, and 60 Newton-Chambers.

[c] All Otto-Hoffman.

[d] Includes 280 Semet-Solvay, 680 Otto-Hoffman, and 60 Newton-Chambers.

[e] Semet-Solvay.

[f] Includes 345 Semet-Solvay, 680 Otto-Hoffman, and 60 Newton-Chambers.

[g] Includes 150 Semet-Solvay and 946 Otto-Hoffman.

[h] Includes 375 Semet-Solvay, 730 Otto-Hoffman, and 60 Newton-Chambers.

[i] Includes 210 Semet-Solvay, 896 Otto-Hoffman, and 427 Schniewind.

The number of completed by-product ovens in existence at the close of 1901 included 375 Semet-Soivay ovens, 730 Otto-Hoffman ovens, and 60 Newton-Chambers ovens, which were distributed as follows:

Semet-Solvay ovens.—Syracuse, N. Y., 30; Dunbar, Pa., 50; Sharon, Pa., 25; Ensley, Ala., 120; Benwood, W. Va., 120; Delray, Mich., 30. In addition to these there were building at the close of 1901, 60 Semet-Solvay ovens at Dunbar, Pa.; 120 at Ensley, Ala., and 30 at Delray, Mich.

Otto-Hoffman ovens.—Johnstown, Pa., 160; Glassport, near Pittsburg, Pa., 120; Everett, near Boston, Mass., 400; Hamilton, Ohio, 50. In addition to these there were under construction at the end of 1901 232 Otto-Hoffman ovens for the Lackawanna Iron and Steel Company at Lebanon, Pa.; 564 for the same company at Buffalo, N. Y., and 100 for the South Jersey Gas, Electric and Traction Company at Camden, N. J.

Newton-Chambers ovens.—Pocahontas, Va., 60.

Schniewind ovens.—These are an improvement made by Dr. Fred. W. C. Schniewind on the Otto-Hoffman ovens. At the close of 1901 there were 200 of these under construction at Sparrows Point, Md., for the Maryland Steel Company; 212 at Sharon, Pa., for the Sharon Coke Company, and 15 at Wyandotte, Mich., for the Michigan Alkali Company.

Of the 1,165 by-product ovens in existence at the close of 1901, 595, or a little more than half, were operated in connection with iron and steel plants. All of the Semet-Solvay ovens, with the exception of 30 at Syracuse, N. Y., and 30 at Delray, Mich., were operated in connection with iron and steel plants which consumed the coke and surplus gas. The Otto-Hoffman ovens at Johnstown, Pa., are operated in connection with the Camden Steel Company, which consumes the coke and surplus gas. Those at Glassport, Pa., manufacture coke for domestic and metallurgical use, and dispose of the surplus gas to rolling mills in the vicinity. The plant at Everett, Mass., which, up to the close of 1901, was the largest one constructed in the United States, manufactures coke for domestic, locomotive, and factory use, and disposes of its surplus gas to the Boston gas companies. The plant at Hamilton, Ohio, completed during 1901, manufactures foundry and domestic coke and sells its surplus gas to the Hamilton Gas Company of that city.

Of the 1,533 ovens in course of construction at the close of the year, 1,176 will be directly associated with blast furnaces or steel plants. The 60 new Semet-Solvay ovens under construction at Dunbar, Pa., will be operated, as the others at that place are, in connection with the Dunbar Furnace Company. The Tennessee Coal, Iron and Railroad Company will use the coke and surplus gas produced at the new Ensley plant of 120 ovens. The Lackawanna Iron and Steel Company, at its plants at Lebanon, Pa., and Buffalo, N. Y., will utilize the coke and gas produced by the Otto-Hoffman ovens building at those points, and the Maryland Steel Company at Sparrows Point will consume the coke and gas made at the Schniewind ovens, now building there.

It may be well at this point to call particular attention to the value of the products obtained in the manufacture of the 1,179,900 tons of coke produced at the by-product ovens in 1901. The total value of the coke produced at these ovens last year amounted to $2,894,077.

The value of the tar, sulphate of ammonia, and ammoniacal liquor produced at the by-product ovens in 1901 was $1,029,876, equivalent to 35 per cent of the value of the coke produced. Assuming that the ammonia and tarry products would average approximately the same for the whole United States, and estimating the values at the prices which obtained throughout 1901, the value of these products which were wasted from coke making in beehive ovens in last year alone would amount to more than $18,000,000, or, allowing for a decline of 50 per cent in values because of a larger production, the loss may be stated at between $9,000,000 and $10,000,000. There is always a good demand for ammonia and ammonia liquor at remunerative prices.

These products in 1901 furnished more than two-thirds of the total value of the by-products, exclusive of the gas.

At most of the establishments no account whatever is taken of the gas produced. It is not measured, nor is any value placed upon it. It may be estimated, however, at about 12,000,000,000 cubic feet in 1901, which, at 25 cents per thousand cubic feet, would be worth $3,000,000.

It can be readily seen from this that even at much lower prices the value of the by-products really exceeds that of the coke produced. The late Joseph D. Weeks, in the course of an investigation into by-product coke making in Germany, ascertained that in some instances the by-products paid all the costs of coal mining, coke making, depreciation of plant, etc., and that the resultant coke was absolutely net profit to the producer.

The values on the tar products given in this report are for the crude tar at the works. As shown later, the values are much enhanced by the manufacture into aniline colors, salts, etc., and into other chemical products.

In the following table is shown the record of by-product coke ovens, by States, at the close of 1900 and 1901:

Record of by-product ovens by States.

State.	Ovens December 31, 1900.		Ovens December 31, 1901.	
	Completed.	Building.	Completed.	Building.
Alabama	120	120	120	120
Maryland	0	0	0	200
Massachusetts	400	0	400	0
Michigan	0	30	30	45
New Jersey	0	100	0	100
New York	30	564	30	564
Ohio	0	50	50	0
Pennsylvania	355	232	355	504
Virginia	60	0	60	0
West Virginia	120	0	120	0
Total	1,085	1,096	1,165	1,533

The following tables show the amount of tar and ammonia produced in 1899 and 1900 and the amount and value of these products produced in 1901:

Amount of tar and ammonia recovered in by-product coke making in 1899 and 1900.

By-product.		1899.	1900.
Tar	pounds	104,687,330	[a] 11,937,448
Ammonia liquor	gallons	1,572,325	90,112
Ammonium sulphate	pounds	11,984,931	26,366,600

[a] Gallons.

Quantity and value of tar and ammonia recovered in by-product coke making in 1901.

By-product.	Quantity.	Value.
Tar ....gallons..	12,695,190	$320,476
Sulphate of ammonia ....pounds..	12,927,627	344,320
Ammonia liquor..........gallons..	2,537,510	365,080
Total..........	....	1,029,876

There is no doubt that the by-product coke-making industry would have increased much more rapidly than it has were it not for the apprehension that, with large amounts of by-products thrown upon the market, prices would so rapidly decline that there would be no margin sufficient to repay the increased outlay necessary for the construction of recovery plants. It does not seem that the amounts so far produced have had any appreciable effect upon the market. On the other hand, the indications are that, once assured of a steady supply of these materials, a demand for them, particularly the tarry products for chemical manufacture, would be created. In fact, the consumers of coal-tar product in the United States are paying from $10,000,000 to $12,000,000 annually for these materials, imported principally from Germany. The value of the coal-tar products imported into the United States in 1901 was $6,139,559, upon which $1,300,901 duty was paid, making a total cost, exclusive of freight, of $7,440,460. The values are for the products at the point of shipment. Adding freight charges, insurance, profits of middlemen, etc., it can be readily seen that the actual cost to the consumer has not been overstated in the above amount.

Ammonia is obtained at the retort ovens in the form of a weak liquor, containing ammonium sulphide and ammonium carbonate. It is concentrated into a crude, impure liquor containing from 20 to 25 per cent NH_3, 40 to 45 grams per liter of H_2S, and from 100 to 120 grams per liter of CO_2. Some of this liquor is sold as ammonia liquor and some is worked up into various ammonium compounds, such as ammonium chloride, ammonium carbonate, ammonium sulphate, aqua ammonia, and anhydrous ammonia.

At some works all the liquor is worked up into ammonium sulphate and sold as such.

Considerable quantities of ammonium chloride and carbonate are imported into the United States, the former being used for galvanizing and electrical purposes, and the latter in the manufacture of baking powders, etc. With a regular supply of these compounds from domestic sources, which will be provided by the extension of the use of by-product ovens, a decrease in the importation may be anticipated. In fact, a decrease of over 10 per cent was shown in 1901. Aqua and anhydrous ammonia are used extensively for refrigerating purposes. Recent discoveries have shown that potassium cyanide, largely used in the treatment of certain classes of gold ores, can be profitably made from ammonia. Any excess of production will be readily taken, though possibly at lower prices, for fertilizing purposes.

Another important by-product, a constituent of the gas, which thus far has not been recovered, is cyanogen. It is an impurity in the gas and may be removed by the use of an alkaline iron salt. The cyanogen is formed into a ferrocyanide of potassium or sodium in solution; the solution is evaporated to the crystallizing point and the crystals are then purified. The amount of cyanogen obtained varies according to the amount of volatile matter in the coal and the percentage of nitrogen, and with the temperature to which the ovens are heated, high temperature tending to increase the cyanogen in the gas.

At present the principal use made of coal tar is in the manufacture of roofing paper, the creosoting of lumber, and for street paving. With the development of the chemical manufacturing industry in the United States the demand for coal tar will be increased and prices will probably be advanced. Chemical manufacturers who use coal tar as a crude material in the manufacture of aniline colors, salts, etc., are now assured of a steady supply of raw material. The statistics of the imports of coal-tar products into the United States are themselves sufficient argument in favor of the utilization of our coal tar in this manner. In order to show to what an extent the coal-tar products are consumed in the United States, the following table has been prepared. It shows that in 1896 we imported $4,713,200 worth of these chemicals. In 1901 we imported coal-tar products to the value of $6,139,559, exclusive of duty, freight, and other charges.

Coal-tar products imported into the United States during the fiscal years 1896 to 1901, inclusive.

Fiscal year.	Salicylic.		Alizarine and colors or dyes, natural and artificial.		Aniline salts.		Coal-tar colors or dyes, not specially provided for.	
	Value.	Duty.	Value.	Duty.	Value.	Duty.	Value.	Duty.
1896	$138,013	Free.	$994,395	Free.	$662,459	Free.	$2,918,333	$729,583
1897	201,980	Free.	1,023,425	Free.	812,884	Free.	3,163,182	790,796
1898	28,688	$6,794	886,349	Free.	1,087,704	Free.	3,723,288	1,098,532
1899	57,192	18,536	700,786	Free.	743,130	Free.	3,900,099	1,170,030
1900	89,175	24,069	771,336	Free.	537,812	Free.	4,792,103	1,437,631
1901	76,786	22,227	713,392	Free.	589,535	Free.	4,034,171	1,210,251

Fiscal year.	Coal-tar, all preparations, not colors or dyes.		Coal-tar products, not medicinal, not dyes, known as benzol, toluol, etc.		Total.	
	Value.	Duty.	Value.	Duty.	Value.	Duty.
1896	....	....	....	....	$4,713,200	$729,583
1897	....	....	....	....	5,201,471	790,796
1898	$134,416	$26,883	$228,037	Free.	6,088,482	1,132,209
1899	221,101	44,220	393,602	Free.	6,015,910	1,232,786
1900	274,946	54,989	397,780	Free.	6,863,152	1,516,689
1901	342,116	68,423	383,559	Free.	6,139,559	1,300,901

IMPORTS AND EXPORTS.

The following table gives the quantities and value of coke imported and entered for consumption in the United States from 1869 to 1901, inclusive. In the reports of the Treasury Department the quantities given are long tons. These have been reduced to short tons to make the tables consistent with other tables in this report. The imports in 1901 were 42,829 short tons less than in 1900:

Coke imported and entered for consumption in the United States, 1869 to 1901, inclusive.

Year ending June 30—	Quantity.	Value.	Year ending Dec. 31—	Quantity.	Value.
	Short tons.			*Short tons.*	
1869	....	$2,053	1886	28,124	$84,801
1870	....	6,388	1887	35,320	100,312
1871	....	19,528	1888	35,201	107,914
1872	9,575	9,217	1889	28,608	88,008
1873	1,091	1,366	1890	20,808	101,767
1874	634	4,588	1891	50,753	223,184
1875	1,046	9,648	1892	27,420	86,350
1876	2,065	8,657	1893	37,183	99,683
1877	4,068	16,686	1894	32,566	70,359
1878	6,616	24,186	1895	29,622	71,366
1879	6,035	24,748	1896	43,372	114,713
1880	5,047	18,406	1897	34,937	98,077
1881	15,210	64,987	1898	46,127	142,334
1882	14,924	53,244	1899	31,197	142,504
1883	20,634	113,114	1900	115,556	371,341
1884	14,483	36,278	1901	72,727	266,075
1885	20,876	64,814			

The amount and value of coke exported from the United States have increased each year since 1895, as shown in the following table:

Coke exported from the United States since 1895.

Year.	Quantity.	Value.	Year.	Quantity.	Value.
	Short tons.			*Short tons.*	
1895	131,368	$425,174	1899	280,196	$858,856
1896	169,189	553,600	1900	422,239	1,358,968
1897	173,034	546,066	1901	430,450	1,561,898
1898	199,562	600,931			

PRODUCTION OF COKE BY STATES.

ALABAMA.

Alabama ranks third among the coke-producing States, being exceeded only by Pennsylvania and West Virginia, the latter by a margin of about 5 per cent. The product of coke in Alabama in 1901 amounted to 2,148,911 short tons, as compared with 2,110,837 short tons in 1900, indicating a gain of 38,074 short tons, or 1.8 per cent. The increase of 1900 over 1899 was 323,028 short tons, or 18 per cent. Both years were record makers in both the amount and the value of the product. The value of the coke produced in 1900 was $1,994,952 more than that of the preceding year, a gain of 55 per cent. In 1901 the value of the product shows an increase of $433,193, or about 8 per cent. Alabama was one of the few States in which the average selling price for coke in 1901 exceeded that of 1900, the price advancing from $2.67 to $2.85. There were only two years (1880 and 1881) in the history of coke production in Alabama when the price exceeded that of last year.

The number of ovens in existence in Alabama at the close of 1901 was 7,136. The number of ovens idle throughout the year was 196. The completed and active ovens included 120 Semet-Solvay ovens at Ensley. This plant has proved so successful that another plant of the same number of ovens was begun last year and will probably be completed before the close of 1902. There were altogether 535 new ovens in course of construction at the close of 1901.

The coke product of Alabama in 1901 was almost exactly double that of 1890 and more than 35 times that of 1880.

The coal fields of Alabama are divided into three districts, known by the rivers which drain them—the Warrior, the Coosa, and the Cahaba. By far the most important of these is the Warrior, which includes the coke ovens in and around the city of Birmingham. Of the 7,136 ovens in the State, 6,609 are in the Warrior district, and this district produced 96 per cent of the total output of the State. The other 4 per cent was produced by the Cahaba district. The Coosa district, which produced a small amount of coke in 1900, did not report any output in 1901, the 60 ovens at Coal City being idle throughout the year. There were, however, 50 new ovens at Coosa Valley in course of construction at the close of 1901, and it is anticipated that this district will again become a producer during the present year.

The statistics of coke production in Alabama since 1880 are as follows:

Statistics of the manufacture of coke in Alabama from 1880 to 1901, inclusive.

Year.	Establishments.	Ovens.		Coal used.	Coke produced.	Total value of coke at ovens.	Value of coke at ovens, per ton.	Yield of coal in coke.
		Built.	Building.					
				Short tons.	*Short tons.*			*Per cent.*
1880	4	316	100	106,283	60,781	$183,063	$3.01	57
1881	4	416	120	184,881	109,033	326,819	3.00	59
1882	5	536	....	261,839	152,940	425,940	2.79	58
1883	6	767	122	359,699	217,531	598,473	2.75	60
1884	8	[a] 976	242	413,184	244,009	609,185	2.50	60
1885	11	1,075	16	507,934	301,180	755,645	2.50	59
1886	14	[a] 1,301	1,012	635,120	375,054	993,302	2.65	59
1887	15	1,555	1,362	550,047	325,020	775,090	2.39	59
1888	18	2,475	406	848,608	508,511	1,189,579	2.34	60
1889	19	3,944	427	1,746,277	1,030,510	2,372,417	2.30	59
1890	20	4,805	371	1,809,964	1,072,942	2,589,447	2.41	59
1891	21	5,068	50	2,144,277	1,282,496	2,986,242	2.33	60
1892	20	5,320	90	2,585,966	1,501,571	3,464,623	2.31	58
1893	23	5,548	60	2,015,398	1,168,085	2,648,632	2.27	58
1894	22	5,551	50	1,574,245	923,817	1,871,348	2.025	58.7
1895	22	5,658	50	2,459,465	1,444,339	3,033,521	2.10	58.7
1896	24	5,363	....	2,573,713	1,479,437	3,064,960	2.07	57.5
1897	25	5,365	[b] 120	2,451,475	1,443,017	3,094,461	2.14	58.8
1898	25	[c] 5,456	100	2,814,615	1,663,020	3,378,946	2.03	59
1899	25	[c] 5,599	850	3,028,472	1,787,809	3,634,471	2.03	59
1900	30	[c] 6,529	[c] 690	3,582,547	2,110,837	5,629,423	2.667	58.9
1901	31	[c] 7,136	[c] 535	3,849,908	2,148,911	6,062,616	2.82	55.8

[a] One establishment made coke on the ground.

[b] Semet-Solvay ovens.

[c] Includes 120 Semet-Solvay ovens.

The character of the coal used in the manufacture of coke in Alabama since 1890 is shown in the following table:

Character of coal used in the manufacture of coke in Alabama since 1890.

[Short tons.]

Year.	Run of mine.		Slack.		Total.
	Unwashed.	Washed.	Unwashed.	Washed.	
1890	1,480,669	0	206,106	123,189	1,809,964
1891	1,943,469	0	192,238	8,570	2,144,277
1892	2,463,366	0	11,100	111,500	2,585,966
1893	1,246,307	51,163	292,198	425,730	2,015,398
1894	411,097	7,429	477,820	677,899	1,574,245
1895	1,208,020	0	32,068	1,219,377	2,459,465
1896	1,292,191	70,125	51,674	1,159,723	2,573,713
1897	902,310	120,420	91,200	1,337,545	2,451,475
1898	1,290,794	828,294	25,000	670,527	2,814,615
1899	1,656,226	725,238	9,898	637,110	3,028,472
1900	1,729,882	152,077	165,418	1,535,170	3,582,547
1901	1,641,830	491,298	17,796	1,698,984	3,849,908

It will be observed in the above table that there has been a decided increase in the amount of Alabama coal which is washed before being charged into the ovens. In 1900 somewhat less than 50 per cent of the coal used was washed before coking. In 1901 nearly 60 per cent was washed, and of the washed coal about 80 per cent was slack.

COLORADO AND UTAH.

Colorado holds the relative position west of the Mississippi River as a coke-producing State that Pennsylvania holds in the United States, and while its product of coke has not yet reached as high as 1,000,000 tons in any year, it ranks fifth among the coke-producing States. The production in 1901 amounted to 671,303 short tons, an increase of 52,548 tons, or 8.5 per cent, over that of the preceding year. This production includes that of Utah, as, there being but one plant in the latter State, it is necessary to include its output with that of another State in order to maintain the confidential nature of individual statements. The average price of coke for the two States declined from $2.82 in 1900 to $2.42 in 1901, and the total value declined from $1,746,732 to $1,626,279, a net loss of $120,453. The statistics of the production of coke in Colorado and Utah from 1880 to 1901 are given in the following table. In 1880 there was only one plant in operation, with a total of 200 ovens. In 1890 the number of establishments had increased to 8, the number of ovens to 916, and the production had increased about ten times. With the exception of the panic period of 1893 and 1894, the production has almost steadily increased, reaching its maximum in 1901. A notable increase is to be observed in the number of ovens constructed during 1901 and the number building at the close of the year. The number of new ovens added to the State's total in 1901 was 572, increasing the total number in existence from 1,488 at the close of 1900 to 2,060 at the close of 1901. In addition to these there were 1,203 ovens building at the close of last year, more than 50 per cent of the total number previously existing, and by far the largest number ever in course of construction in the State. This phenomenal increase in oven building in Colorado has been due to the demand for coke created by the extensive additions to the steel works of the Colorado Fuel and Iron Company, at Minnequa, near Pueblo.

Statistics of the manufacture of coke in Colorado and Utah from 1880 to 1901, inclusive.

Year.	Establishments.	Ovens.		Coal used.	Coke produced.	Total value of coke at ovens.	Value of coke at ovens, per ton.	Yield of coal in coke.
		Built.	Building.					
				Short tons.	*Short tons.*			*Per cent.*
1880	1	200	50	51,891	25,568	$145,226	$5.68	49
1881	2	267	0	97,508	48,587	267,156	5.29	50
1882	5	344	0	180,549	102,105	476,665	4.67	57
1883	7	352	0	224,089	133,997	584,578	4.36	60
1884	8	409	24	181,968	115,719	409,930	3.45	64
1885	7	434	0	208,069	131,960	512,162	3.88	63
1886	7	483	0	228,060	142,797	569,120	3.99	62.6
1887	7	532	0	267,487	170,698	682,778	4.00	64
1888	7	602	100	274,212	179,682	716,305	4.00	65.6
1889	9	834	50	299,731	187,638	643,479	3.43	63
1890	8	916	30	407,023	245,756	959,246	3.90	60
1891	7	948	21	452,749	277,074	896,984	3.24	61
1892[a]	9	[b]1,128	220	599,200	373,229	1,234,320	3.31	62.3
1893[a]	8	1,154	200	628,935	362,986	1,137,488	3.13	57.7
1894[a]	8	1,154	250	542,429	317,196	903,970	2.85	58.5
1895[a]	9	1,169	0	580,584	340,357	940,987	2.76	58.6
1896[a]	11	1,275	0	639,238	363,760	1,046,306	2.88	56.9
1897[a]	12	1,273	0	616,592	342,653	999,216	2.916	55.6
1898[a]	12	1,253	3	803,686	474,808	1,230,428	2.59	59.8
1899[a]	12	1,243	50	898,207	530,424	1,333,769	2.51	59
1900[a]	13	1,488	0	997,861	618,755	1,746,732	2.82	62
1901[a]	15	2,060	1,203	1,148,901	671,303	1,626,279	2.42	58.4

[a] Includes production and value of coke in Utah and of coal coked.
[b] Includes 36 gas retorts since 1892.

The character of the coal used in the manufacture of coke in Colorado and Utah since 1890 is shown in the following table:

Character of coal used in the manufacture of coke in Colorado and Utah since 1890.

[Short tons.]

Year.	Run of mine.		Slack.		Total.
	Unwashed.	Washed.	Unwashed.	Washed.	
1890	36,058	0	395,023	0	431,081
1891	93,752	0	384,278	0	478,030
1892	82,098	0	517,102	0	599,200
1893	109,915	0	519,020	0	628,935
1894	126,642	0	415,787	0	542,429
1895	119,868	0	453,597	7,119	580,584
1896	143,604	0	378,776	116,858	639,238
1897	0	0	393,214	223,378	616,592
1898	122,983	0	415,298	265,405	803,686
1899	125,322	0	468,196	304,689	898,207
1900	229,311	0	316,527	452,023	997,861
1901	428,642	0	43,078	677,181	1,148,901

As will be observed in the foregoing table, the larger part of the coal used in the production of coke in Colorado and Utah is slack, although there was a very decided increase in the amount of run-of-mine coal used in 1901. There has been a steady increase each year since 1895 in the amount of slack coal washed before coking. The first washery was put up in 1895, and 7,119 tons of slack coal were washed that year. In 1901, 677,181 tons, or 94 per cent of the entire slack coal used, were washed.

GEORGIA.

The only coal mines in the State of Georgia are located in Dade and Walker counties, in the extreme northwest corner of the State, the coal beds being a portion of the Warrior coal fields of Alabama. The coal in Georgia produces a fairly good quality of coke—although it is only the slack coal that is used for that purpose—which finds a market in the iron works in the vicinity of Chattanooga, Tenn.

The production of coke in 1901 was 54,550 short tons, a decrease of 19,378 short tons, as compared with 1900, when the product amounted to 73,928 tons. The decrease in coke production was due to the unusual demand for coal, there being no run-of-mine coal available for the coke ovens during the entire year.

The statistics of the production of coke in Georgia, 1880 to 1901, are as follows:

Statistics of the manufacture of coke in Georgia, 1880 to 1901, inclusive.

Year.	Establishments.	Ovens.		Coal used.	Coke produced.	Total value of coke at ovens.	Value of coke at ovens, per ton.	Yield of coal in coke.
		Built.	Building.					
				Short tons.	*Short tons.*			*Per cent.*
1880	1	140	40	63,402	38,041	$81,789	$2.15	60
1881	1	180	40	68,960	41,376	88,753	2.15	60
1882	1	220	44	77,670	46,602	100,194	2.15	60
1883	1	264	36	111,687	67,012	147,166	2.20	60
1884	1	300	0	132,113	79,268	169,192	2.13	60
1885	2	300	0	117,781	70,669	144,198	2.04	60
1886	2	300	0	136,133	82,680	179,031	2.17	60
1887	2	300	0	158,482	79,241	174,410	2.20	50
1888	1	290	0	140,000	83,721	177,907	2.12	60
1889	1	300	0	157,878	94,727	149,059	1.57	60
1890	1	300	0	170,388	102,233	150,995	1.48	60
1891	1	300	0	164 875	103,057	231,878	2.25	62.5
1892	1	300	0	158,978	81,807	163,614	2.00	51.5
1893	1	338	0	171,645	90,726	136,089	1.50	52.8
1894	1	338	0	166,523	93,029	116,286	1.25	55.9
1895	1	330	0	118,900	60,212	70,580	1.17	50.6
1896	1	334	0	109,655	53,673	68,486	1.276	49
1897	1	300	0	67,000	33,000	42,240	1.28	49.3
1898	2	350	0	81,108	49,529	77,230	1.56	61
1899	2	350	100	78,098	50,907	116,917	2.30	65.2
1900	2	480	0	140,988	73,928	210,646	2.849	52.4
1901	2	510	0	89,919	54,550	154,625	2.83	60.7

As shown in the following table, nearly all of the coal used in the manufacture of coke in Georgia since 1890 was washed before being charged into the ovens.

Character of coal used in the manufacture of coke in Georgia since 1890.

[Short tons.]

Year.	Run of mine.		Slack.		Total.
	Unwashed.	Washed.	Unwashed.	Washed.	
1890	0	0	0	170,388	170,388
1891	106,131	0	0	58,744	164,875
1892	0	0	0	158,978	158,978
1893	0	0	0	171,645	171,645
1894	0	166,523	0	0	166,523
1895	0	118,900	0	0	118,900
1896	0	109,655	0	0	109,655
1897	0	67,000	0	0	67,000
1898	0	61,844	0	19,264	81,108
1899	0	48,521	0	29,577	78,098
1900	0	68,988	0	72,000	140,988
1901	0	0	10,574	79,345	89,919

INDIAN TERRITORY.

There was no material difference between the production of coke in Indian Territory in 1901 and that of the preceding year. The product last year amounted to 37,374 short tons, as against 38,141 short tons in 1900, the decrease being about 2 per cent. There was an advance of 15 cents in the average price obtained per ton, and the total value advanced from $152,204 to $154,834. The number of ovens in existence was the same both years, and there were no new ovens in course of construction at the close of 1901. There were 3 establishments in the Territory, all of which were operated last year.

The statistics of the manufacture of coke in the Indian Territory from 1880 to 1901 are as follows:

Statistics of the manufacture of coke in the Indian Territory from 1880 to 1901, inclusive.

Year.	Establishments.	Ovens.		Coal used.	Coke produced.	Total value of coke at ovens.	Value of coke at ovens, per ton.	Yield of coal in coke.
		Built.	Building.					
				Short tons.	*Short tons.*			*Per cent.*
1880	1	20	0	2,494	1,546	$4,638	$3.00	62
1881	1	20	0	2,852	1,768	5,304	3.00	62
1882	1	20	0	3,266	2,025	6,075	3.00	62
1883	1	20	0	4,150	2,573	7,719	3.00	62
1884	1	20	0	3,084	1,912	5,736	3.00	62
1885	1	40	0	5,781	3,584	12,902	3.60	62
1886	1	40	0	10,242	6,351	22,229	3.30	62
1887	1	80	0	20,121	10,060	33,435	3.33	50
1888	1	80	0	13,126	7,502	21,755	2.90	57
1889	1	80	0	13,277	6,639	17,957	2.70	50
1890	1	80	0	13,278	6,639	21,577	3.25	50
1891	1	80	0	20,551	9,464	30,483	3.22	46
1892	1	80	0	7,138	3,569	12,402	3.47	50
1893	1	80	0	15,118	7,135	25,072	3.51	47
1894	1	80	0	7,274	3,051	10,693	3.50	42
1895	1	80	0	11,825	5,175	17,657	3.41	43.8
1896	2	130	0	53,028	21,021	73,574	3.50	40
1897	2	130	0	68,495	30,364	104,725	3.45	44.3
1898	2	130	0	73,330	34,110	96,639	2.833	46.5
1899	3	130	100	59,255	34,339	71,965	2.96	41
1900	3	230	0	79,534	38,141	152,204	3.99	48
1901	3	230	0	74,746	37,374	154,834	4.14	50

The character of the coal used in the manufacture of coke in the Indian Territory since 1890 is shown in the following table:

Character of coal used in the manufacture of coke in the Indian Territory since 1890.

[Short tons.]

Year.	Run of mine.		Slack.		Total.
	Unwashed.	Washed.	Unwashed.	Washed.	
1890	0	0	0	13,278	13,278
1891	0	0	9,500	11,051	20,551
1892	0	0	0	7,138	7,138
1893	0	0	0	15,118	15,118
1894	0	0	0	7,274	7,274
1895	0	0	0	11,825	11,825
1896	0	0	0	53,028	53,028
1897	0	6,923	0	61,572	68,495
1898	0	15,353	0	57,977	73,330
1899	0	0	0	59,255	59,255
1900	0	0	20,832	58,702	79,534
1901	0	0	0	74,746	74,746

KANSAS.

Kansas as a coke producer continues to be of comparatively little importance, the small amount of coke produced in the State being made by zinc-producing companies for their own use. There were 98 ovens in existence in Kansas at the end of 1901, but in only 59 of them was coke made during the year. One plant of 50 ovens was operated for only a short time and produced less coke than either of the other two plants, one with 3 ovens and the other with 6. The total product in 1900 amounted to 7,138 short tons, as against 5,948 tons in 1900.

The statistics of the manufacture of coke in Kansas from 1880 to 1901 are as follows:

Statistics of the manufacture of coke in Kansas from 1880 to 1901, inclusive.

Year.	Establishments.	Ovens.		Coal used.	Coke produced.	Total value of coke at ovens.	Value of coke at ovens, per ton.	Yield of coal in coke.
		Built.	Building.					
				Short tons.	*Short tons.*			*Per cent.*
1880	2	6	....	4,800	3,070	$6,000	$1.95	64
1881	3	15	....	8,800	5,670	10,200	1.80	64.4
1882	3	20	....	9,200	6,080	11,460	1.70	66
1883	4	23	....	13,400	8,430	16,560	1.96	62.9
1884	4	23	....	11,500	7,190	14,580	2.02	62.5
1885	4	23	....	15,000	8,050	13,255	1.65	53.7
1886	4	36	....	23,062	12,493	19,204	1.54	54.2
1887	4	39	....	27,604	14,950	28,575	1.91	54
1888	6	58	....	24,934	14,831	29,073	1.96	59.5
1889	6	68	....	21,600	13,910	26,593	1.91	64
1890	7	68	....	21,809	12,311	29,116	2.37	56
1891	6	72	....	27,181	14,174	33,296	2.35	52
1892	6	75	....	15,437	9,132	19,906	2.18	59.2
1893	6	75	0	13,645	8,565	18,640	2.18	62.8
1894	6	61	0	13,288	8,439	15,660	1.855	63.5
1895	5	55	0	8,424	5,287	11,289	2.14	62.8
1896	6	55	0	8,940	4,785	8,676	1.813	53.5
1897	4	57	0	11,772	6,181	9,272	1.50	52.5
1898	6	47	50	7,856	4,180	6,455	1.545	53
1899	9	95	0	26,988	14,476	30,817	2.13	53.6
1900	9	91	0	10,303	5,948	14,985	2.52	57.7
1901	12	98	3	11,629	7,138	15,079	2.11	61.4

The character of the coal used in the manufacture of coke in Kansas since 1890 is shown in the following table:

Character of coal used in the manufacture of coke in Kansas since 1890.

[Short tons.]

Year.	Run of mine.		Slack.		Total.
	Unwashed.	Washed.	Unwashed.	Washed.	
1890	0	0	19,619	2,190	21,809
1891	0	0	27,181	0	27,181
1892	0	0	15,437	0	15,437
1893	0	0	12,445	1,200	13,645
1894	0	0	13,288	0	13,288
1895	0	0	8,424	0	8,424
1896	0	0	8,940	0	8,940
1897	0	0	11,772	0	11,772
1898	0	0	7,856	0	7,856
1899	0	6,210	20,778	0	26,988
1900	0	3,786	6,517	0	10,303
1901	0	3,839	4,140	3,650	11,629

KENTUCKY.

The coke production of Kentucky in 1901 was the largest in the history of the State, amounting to 100,285 short tons, as against 95,532 short tons in 1900. The average price per ton, however, declined from $2.465 to $2.07, and the total value from $235,505 to $208,015. The coking industry of the State depends for its existence principally upon the slack coal produced at the coal mines of the State. Kentucky is the only State which contains within its borders the Coal Measures of any two of the great fields. The Appalachian coal area crosses the eastern end of the State, while the southern extremity of the Illinois and Indiana, or Central, field is found in the western counties of Kentucky. Coke is made from coal mined from both fields, one of the principal coke plants being that of the St. Bernard Coal Mining Company at Earlington, Hopkins County, which has been able to produce a good quality of coke from these coals, although practically no coke is made from the more extensively developed portions of the field in Illinois and Indiana.

The statistics of the manufacture of coke in Kentucky from 1880 to 1901 are as follows:

Statistics of the manufacture of coke in Kentucky from 1880 to 1901, inclusive.

Year.	Establishments.	Ovens.		Coal used.	Coke produced.	Total value of coke at ovens.	Value of coke at ovens, per ton.	Yield of coal in coke.
		Built.	Building.					
				Short tons.	*Short tons.*			*Per cent.*
1880	5	45	....	7,206	4,250	$12,250	$2.88	59
1881	5	45	....	7,406	4,370	12,630	2.89	59
1882	5	45	....	6,906	4,070	11,530	2.83	59
1883	5	45	....	8,437	5,025	14,425	2.87	60
1884	5	45	....	3,451	2,223	8,760	3.94	64
1885	5	33	....	5,075	2,704	8,489	3.14	53
1886	6	76	2	9,055	4,528	10,082	2.23	50
1887	6	98	....	29,129	14,565	31,730	2.18	50
1888	10	132	2	42,642	23,150	47,244	2.04	54
1889	9	166	100	25,192	13,021	29,769	2.28	52
1890	9	175	103	24,372	12,343	22,191	1.80	51
1891	7	115	24	64,390	33,777	68,281	2.02	52
1892	5	287	100	70,783	36,123	72,563	2.01	51
1893	4	283	100	97,212	48,619	97,350	2.00	50
1894	6	293	0	66,418	29,748	51,566	1.73	44.8
1895	5	293	0	63,419	25,460	37,249	1.46	40.1
1896	4	264	0	55,719	27,107	42,062	1.55	48.6
1897	5	268	0	64,234	32,117	45,454	1.41	50
1898	5	292	2	44,484	22,242	32,213	1.448	50
1899	6	300	130	151,503	81,095	161,454	1.99	53.5
1900	5	458	3	190,268	95,532	235,505	2.465	50.2
1901	5	461	0	204,297	100,285	208,015	2.07	49

The character of the coal used in the manufacture of coke in Kentucky since 1890 is shown in the following table:

Character of coal used in the manufacture of coke in Kentucky since 1890.

[Short tons.]

Year.	Run of mine.		Slack.		Total.
	Unwashed.	Washed.	Unwashed.	Washed.	
1890	0	3,000	2,100	19,272	24,372
1891	11,000	0	3,500	49,890	64,390
1892	0	5,955	7,883	56,945	70,783
1893	825	11,973	26,759	57,655	97,212
1894	0	2,980	7,900	55,538	66,418
1895	0	502	624	62,293	63,419
1896	16,271	0	0	39,448	55,719
1897	4,176	0	0	60,058	64,234
1898	0	1,800	0	42,684	44,484
1899	21,600	0	30,263	99,640	151,503
1900	6,043	17,717	78,583	87,925	190,268
1901	0	28,000	67,311	108,986	204,297

MISSOURI.

The coke-making industry in Missouri is insignificant in amount, and the conditions affecting it are similar to those mentioned in discussing the industry in Kansas. The small amount of coke produced in the State is from ovens operated in connection with the lead and zinc smelters for their own use. The production in 1901 was 4,749 tons, an increase of 2,662 tons over 1900, and the largest production since 1893.

The statistics of the production of coke in Missouri from 1887, when coking began in this State, to 1901 are as follows:

Statistics of the manufacture of coke in Missouri from 1887 to 1901, inclusive.

Year.	Establishments.	Ovens.		Coal used.	Coke produced.	Total value of coke at ovens.	Value of coke at ovens, per ton.	Yield of coal in coke.
		Built.	Building.					
				Short tons.	*Short tons.*			*Per cent.*
1887	1	4	....	5,400	2,970	$10,395	$3.50	55
1888	1	4	....	5,000	2,600	9,100	3.50	52
1889	3	9	....	8,485	5,275	5,800	1.10	62
1890	3	10	....	9,491	6,136	9,240	1.51	65
1891	3	10	....	10,377	6,872	10,000	1.45	66
1892	3	10	....	11,088	7,299	10,949	1.50	65.8
1893	3	10	0	8,875	5,905	9,735	1.65	66.5
1894	3	10	0	3,442	2,250	3,563	1.58	65.4
1895	3	10	0	3,120	2,028	2,442	1.20	65
1896	3	7	0	4,471	2,500	4,131	1.65	55.9
1897	3	15	0	4,627	2,593	3,890	1.50	56
1898	3	8	0	1,500	740	1,050	1.42	49.3
1899	4	12	0	5,320	2,860	5,520	1.93	53.8
1900	3	10	0	3,775	2,087	5,268	2.52	55.3
1901	3	9	0	9,041	4,749	9,968	2.099	52.5

The character of the coal used for coke in Missouri since 1890 is shown in the following table:

Character of coal used in the manufacture of coke in Missouri since 1890.

[Short tons.]

Year.	Run of mine.		Slack.		Total.
	Unwashed.	Washed.	Unwashed.	Washed.	
1890	0	0	9,491	0	9,491
1891	0	0	10,377	0	10,377
1892	0	0	11,088	0	11,088
1893	0	0	8,875	0	8,875
1894	0	0	3,442	0	3,442
1895	0	0	3,120	0	3,120
1896	0	0	4,471	0	4,471
1897	0	0	4,627	0	4,627
1898	0	0	1,500	0	1,500
1899	0	0	5,320	0	5,320
1900	0	0	2,680	1,095	3,775
1901	0	0	1,741	7,300	9,041

MONTANA.

There are three coking establishments in Montana, only two of which, however, were operated in 1901. These produced a total of 57,004 short tons, valued at $337,381, a slight increase over the preceding year, when the product amounted to 54,731 short tons. The new plant of the Montana Coal and Coke Company, which was mentioned as being under construction at the close of 1900, had not been completed at the end of 1901 and did not, therefore, add to the product of last year.

The statistics of the manufacture of coke in Montana from 1883, when ovens were first reported, to 1901 are as follows:

Statistics of the manufacture of coke in Montana from 1883 to 1901, inclusive.

Year.	Establishments.	Ovens.		Coal used.	Coke produced.	Total value of coke at ovens.	Value of coke at ovens, per ton.	Yield of coal in coke.
		Built.	Building.					
				Short tons.	*Short tons.*			*Per cent.*
1883	1	2	0	0	0	0	0	0
1884	3	5	12	165	75	$900	$12.00	46
1885	2	2	0	300	175	2,063	11.72	58.5
1886	4	16	0	0	0	0	0	0
1887	2	27	0	10,800	7,200	72,000	10.00	66.7
1888	1	40	0	20,000	12,000	96,000	8.00	60
1889	2	90	50	30,576	14,043	122,023	8.69	46
1890	2	140	0	32,148	14,427	125,655	8.71	45
1891	2	140	0	61,667	29,009	258,523	8.91	47
1892	2	153	0	64,412	34,557	311,013	9.00	53.6
1893	2	153	0	61,770	29,945	239,560	8.00	48.5
1894	2	153	0	33,313	17,388	165,187	9.50	52.2
1895	3	303	0	55,770	25,337	189,856	7.49	45.4
1896	3	303	0	113,165	60,078	425,483	7.08	53
1897	3	303	0	139,907	67,849	467,481	6.89	48.5
1898	4	318	0	92,552	52,009	359,174	6.91	56
1899	3	303	0	110,274	56,376	356,190	6.32	51
1900	3	342	111	108,710	54,731	337,079	6.159	50.3
1901	3	328	111	102,950	57,004	337,381	5.918	55.4

The character of the coal used in the manufacture of coke in Montana since 1890 is shown in the following table:

Character of coal used in the manufacture of coke in Montana since 1890.

[Short tons.]

Year.	Run of mine.		Slack.		Total.
	Unwashed.	Washed.	Unwashed.	Washed.	
1890	0	22,852	0	9,296	32,148
1891	0	34,000	0	27,667	61,667
1892	0	28,000	0	36,412	64,412
1893	0	44,000	0	17,770	61,770
1894	0	33,313	0	0	33,313
1895	0	0	0	55,770	55,770
1896	0	50,000	0	63,165	113,165
1897	0	75,000	0	64,907	139,907
1898	12,000	60,000	0	20,552	92,552
1899	0	0	0	110,274	110,274
1900	0	74,475	0	34,235	108,710
1901	0	65,137	0	37,813	102,950

NEW MEXICO.

The production of coke in New Mexico has not changed materially during the last three years. The product in 1901 was 41,643 short tons, as against 44,774 short tons in 1900, and 44,134 short tons in 1899. There are 126 ovens in the Territory, all of which were active during the last three years. No new ovens have been built during the last five years.

The statistics of the production of coke in New Mexico from 1882, when coke ovens were first reported, until 1901 are as follows:

Statistics of the manufacture of coke in New Mexico from 1882 to 1901, inclusive.

Year.	Establishments.	Ovens.		Coal used.	Coke produced.	Total value of coke at ovens.	Value of coke at ovens, per ton.	Yield of coal in coke.
		Built.	Building.					
				Short tons.	*Short tons.*			*Per cent.*
1882	2	0	12	1,500	1,000	$6,000	$6.00	66⅔
1883	2	12	28	6,941	3,905	21,478	5.50	57¼
1884	2	70	0	29,990	18,282	91,410	5.00	57¼
1885	2	70	0	31,889	17,940	89,700	5.00	56¼
1886	2	70	0	18,194	10,236	51,180	5.00	56
1887	1	70	0	22,549	13,710	82,260	6.00	61
1888	1	70	0	14,628	8,540	51,240	6.00	58
1889	2	70	0	7,162	3,460	18,408	5.32	48
1890	2	70	0	3,980	2,050	10,025	4.89	51.5
1891	1	70	0	4,000	2,300	10,925	4.75	57.5
1892	1	50	0	0	0	0	0	0
1893	1	50	0	14,698	5,803	18,476	3.18	39.5
1894	1	50	0	13,042	6,529	28,213	4.32	50
1895	1	50	0	22,385	14,663	29,491	2.01	65.5
1896	1	50	0	39,286	24,228	48,453	2.00	61.7
1897	2	126	0	2,585	1,438	3,232	2.25	55.6
1898	2	126	0	12,557	6,980	14,625	2.095	55.6
1899	2	126	0	68,594	44,134	99,217	2.25	64.3
1900	2	126	0	74,261	44,774	130,251	2.909	60.3
1901	2	126	0	72,350	41,643	118,368	2.84	57.5

The character of the coal used in the manufacture of coke in New Mexico since 1890 is shown in the following table:

Character of coal used in the manufacture of coke in New Mexico since 1890.

[Short tons.]

Year.	Run of mine.		Slack.		Total.
	Unwashed.	Washed.	Unwashed.	Washed.	
1890	3,980	0	0	0	3,980
1891	4,000	0	0	0	4,000
1892	0	0	0	0	0
1893	14,698	0	0	0	14,698
1894	0	0	13,042	0	13,042
1895	....	....	....	....	22,385
1896	0	0	39,286	0	39,286
1897	0	0	2,585	0	2,585
1898	0	0	12,557	0	12,557
1899	0	0	68,594	0	68,594
1900	10,611	0	27,604	36,046	74,261
1901	0	13,830	0	58,520	72,350

NEW YORK.

The principal interest associated with the coke-making industry of New York in 1901 was the building of a bank of 564 Otto-Hoffman by-product ovens at Buffalo by the Lackawana Iron and Steel Company. The plant was not completed, however, before the end of the year, but is expected to be in operation some time during 1902. The statistics of production at the Semet-Solvay plant at Syracuse is included with that of "other States."

OHIO.

Although Ohio ranks fourth among the coal-producing States, and has within its borders extensive areas of coal from which a good quality of coke could be produced for the many iron and steel works of the State, the coke-making industry has never developed into one of particular importance, the consumers seemingly preferring to obtain their supplies from Pennsylvania and West Virginia. A portion of the coke product of the State is made from the slack coal taken from the coal barges on the Ohio River at Cincinnati and from the coal yards of the city. The production of coke in 1901 amounted to 108,774 short tons, an increase of 36,658 short tons, or about 51 per cent over that of the preceding year. The product last year was the largest in the history of the State, with the exception of that of 1881. The increase was due to the completion of the 50 Otto-Hoffman ovens at Hamilton, which were referred to in the earlier part of this report.

In the following table the statistics of the production of coke in the two districts of Ohio for the years 1880 to 1901 are consolidated:

Statistics of the manufacture of coke in Ohio from 1880 to 1901, inclusive.

Year.	Establishments.	Ovens.		Coal used.	Coke produced.	Total value of coke at ovens.	Value of coke at ovens, per ton.	Yield of coal in coke.
		Built.	Building.					
				Short tons.	*Short tons.*			*Per cent.*
1880	15	616	25	172,453	100,596	$255,905	$2.54	58
1881	15	641	0	201,045	119,469	297,728	2.49	59
1882	16	647	0	181,577	103,722	266,113	2.57	57
1883	18	682	0	152,502	87,834	225,660	2.57	58
1884	19	732	0	108,164	62,709	156,294	2.49	58
1885	13	642	0	68,796	39,416	109,723	2.78	57
1886	15	560	0	59,332	34,932	94,042	2.69	59
1887	15	585	223	164,974	93,004	245,981	2.65	56
1888	15	547	12	124,201	67,194	166,330	2.48	54
1889	13	462	0	132,828	75,124	188,222	2.50	56
1890	13	443	1	126,921	74,633	218,090	2.92	59
1891	9	421	0	69,320	38,718	76,901	1.99	56
1892	10	436	0	95,236	51,818	112,907	2.18	54.4
1893	9	435	0	42,963	22,436	43,671	1.95	52
1894	8	363	0	55,324	32,640	90,875	2.78	59
1895	8	377	0	51,921	29,050	69,655	2.40	56
1896	9	431	0	128,923	80,868	208,789	2.58	62.7
1897	9	433	0	151,545	95,087	235,784	2.48	62.7
1898	10	441	0	134,757	85,535	211,558	2.47	63.5
1899	8	385	0	142,678	83,878	255,129	3.04	58.8
1900	8	369	50	115,269	72,116	194,042	2.69	62.5
1901	8	[a]419	0	162,624	108,774	299,430	2.75	66.9

[a] Includes 50 Otto-Hoffman ovens.

The character of the coal used in the manufacture of coke in Ohio since 1890 is shown in the following table:

Character of coal used in the manufacture of coke in Ohio since 1890.

[Short tons.]

Year.	Run of mine.		Slack.		Total.
	Unwashed.	Washed.	Unwashed.	Washed.	
1890	34,729	0	54,473	37,719	126,921
1891	5,200	0	64,120	0	69,320
1892	35,334	0	32,402	27,500	95,236
1893	0	0	24,859	18,104	42,963
1894	0	0	14,845	40,479	55,324
1895	28,053	0	10,868	13,000	51,921
1896	88,616	0	24,325	15,982	128,923
1897	92,192	0	29,353	30,000	151,545
1898	92,963	0	19,794	22,000	134,757
1899	88,771	0	23,907	30,000	142,678
1900	68,175	0	17,094	30,000	115,269
1901	100,345	0	42,279	20,000	162,624

PENNSYLVANIA.

Pennsylvania holds an even higher relative position as a coke producer than it does as a coal producer. The State is credited with about 55 per cent of the total coal product of the United States. As a coke producer it contributes from 65 to 70 per cent of the total product. In 1901 Pennsylvania produced 66 per cent of the total. Moreover, 75 per cent of the entire increase in coke production in 1901, as compared with 1900, was made in Pennsylvania. The coke product of the State in 1901 amounted to 14,355,917 short tons, valued at $27,066,361, as compared with 13,357,295 short tons, valued at $29,692,258, in 1900. This indicates an increase of 998,622 short tons, or 7.4 per cent in production, and a decrease in value of $2,625,897, the average price per ton declining from $2.22 in 1900 to $1.885 in 1901. The Connellsville region was responsible for the principal decline in value, for with an increase of about 200,000 tons the value fell off over $3,000,000 in this the most important coke-producing region of the State. The average price of Connellsville coke declined from $2.23 in 1900 to $1.873 in 1901, the average price for Connellsville coke being less than the general average for the State.

The increase in production of coke in Pennsylvania in 1901 was largely due to the development of the Lower Connellsville or "Klondike" region, the opening of which was mentioned in this report for 1900. The first ovens built in this new territory were completed in the early part of 1900. The first coke was drawn on June 1 of that year. On December 31 it was shown that there were 2,033 ovens built, with 1,112 building. The coke product amounted to 385,909 short tons. At the close of 1901 there were completed in this district 3,251 ovens, and the product amounted to 1,116,379 short tons, an increase of 730,470 tons over the preceding year.

The total number of ovens completed in Pennsylvania at the close of 1901 was 34,906, an increase of 2,358 ovens over 1900. Of the completed ovens in 1901, 1,239 were idle throughout the year. Some of these idle ovens were new ones, completed near the end of the year, and were not put in blast in time to report any production for 1901.

In the following table are given the statistics of the production of coke in Pennsylvania for the years 1880 to 1901, inclusive:

Statistics of the manufacture of coke in Pennsylvania from 1880 to 1901, inclusive.

Year.	Establishments.	Ovens.		Coal used.	Coke produced.	Total value of coke at ovens.	Value of coke at ovens, per ton.	Yield of coal in coke.
		Built.	Building.					
				Short tons.	*Short tons.*			*Per cent.*
1880	124	9,501	836	4,347,558	2,821,384	$5,255,040	$1.86	65
1881	132	10,881	761	5,393,503	3,437,708	5,898,579	1.70	64
1882	137	12,424	642	6,149,179	3,945,034	6,133,698	1.55	64
1883	140	13,610	211	6,823,275	4,438,464	5,410,387	1.22	65
1884	145	14,285	232	6,204,604	3,822,128	4,783,230	1.25	62
1885	133	14,553	317	6,178,500	3,991,805	4,981,656	1.25	64.6
1886	108	16,314	2,558	8,290,849	5,406,597	7,664,023	1.42	65.2
1887	151	18,294	802	8,938,438	5,832,849	10,746,352	1.84	65.3
1888	120	20,381	1,565	9,673,097	6,545,779	8,230,759	1.26	68
1889	109	22,143	567	11,581,292	7,659,055	10,743,492	1.40	66
1890	106	23,430	74	13,046,143	8,560,245	16,333,674	1.91	65.6
1891	109	25,324	11	10,588,544	6,954,846	12,679,826	1.82	66
1892	109	25,366	269	12,591,345	8,327,612	15,015,336	1.80	66.1
1893	102	25,744	19	9,386,702	6,229,051	9,468,036	1.52	66
1894	101	25,824	118	9,059,118	6,063,777	6,585,489	1.086	66.9
1895	99	26,042	170	14,211,567	9,404,215	11,908,162	1.266	66.2
1896[a]	158	26,658	154	11,124,610	7,356,502	13,182,859	1.792	66.1
1897[a]	153	26,910	307	13,538,646	8,966,924	13,727,966	1.53	66.2
1898[a]	151	27,157	292	16,307,841	10,715,302	16,078,505	1.50	65.7
1899[b]	150	27,591	1,666	19,930,419	13,577,870	22,881,910	1.69	68.1
1900	177	32,548	2,310	20,239,966	13,357,295	29,692,258	2.22	66
1901	188	34,906	832	21,736,467	14,355,917	27,066,361	1.885	66

[a] Includes coal used, coke produced, and its value, in New York.
[b] Includes coal used, coke produced, and its value, in Massachusetts and New York.

The quality of the coal produced in the principal coking regions of Pennsylvania is such that it requires little or no preparation for the ovens, and by far the larger part of the coal used in coke making in Pennsylvania is, therefore, unwashed run-of-mine. The fact that all of the increase in the coal consumed in coke making in 1901 over 1900 was in run-of-mine unwashed coal shows that the increased production was from the big coking fields.

The character of the coal used in the manufacture of coke in Pennsylvania since 1890 is shown in the following table:

Character of coal used in the manufacture of coke in Pennsylvania since 1890.

[Short tons.]

Year.	Run-of-mine.		Slack.		Total.
	Unwashed.	Washed.	Unwashed.	Washed.	
1890	11,788,625	303,591	630,195	323,732	13,046,143
1891	9,470,646	256,807	558,106	302,985	10,588,544
1892	11,237,253	159,698	1,059,994	134,400	12,591,345
1893	8,302,307	216,762	739,128	128,505	9,386,702
1894	8,671,534	118,279	204,811	64,494	9,059,118
1895	13,618,376	34,728	440,869	117,594	14,211,567
1896[a]	9,289,089	273,082	1,463,047	99,392	11,124,610
1897[a]	11,540,459	301,052	1,441,611	255,524	13,538,646
1898[a]	14,083,073	350,153	1,472,347	402,268	16,307,841
1899[b]	16,854,706	366,206	1,824,784	884,723	19,930,419
1900	17,692,623	647,045	1,300,796	599,502	20,239,966
1901	19,689,162	647,209	893,476	506,620	21,736,467

[a] Includes coal used in New York.

[b] Includes coal used in Massachusetts and New York.

PRODUCTION BY DISTRICTS.

The coke-producing regions of Pennsylvania were divided by the late Joseph D. Weeks into certain well-defined districts. Such division was made after a careful study not only of the geographic boundaries, but also of the quality of coal mined, and the coke produced. They have been described somewhat fully in preceding volumes of Mineral Resources. As previously stated, a new district was added to the list in 1900, in what has been commonly known as the "Klondike" district, an extension southwest of the Connellsville Basin, which, on account of its position in relation to the Connellsville district, and also from the fact that the coal is not dissimilar to the Connellsville coal, and produces a high grade of Connellsville coke, is designated in this report "Lower Connellsville."

The brief statement published in previous volumes regarding the territory included in the other coking districts is repeated here for sake of convenience.

The Allegheny Mountain district includes the ovens along the line of the Pennsylvania Railroad from Gallitzin eastward over the crest of the Alleghenies to beyond Altoona. The Allegheny Valley district includes the coke works of Armstrong and Butler counties and one of those in Clarion County, the other ovens in the latter county being included in the Reynoldsville-Walston district. What was previously known as the Beaver district included the ovens in Beaver and Mercer counties, but all the ovens in Beaver County have been abandoned, and the operations of the Semet-Solvay ovens in Mercer County are now included in the Pittsburg district. The Blossburg and Broad Top districts embrace the Blossburg and Broad Top coal fields. The ovens of the Clearfield-Center district are chiefly in the two counties from which it derives its name. The Connellsville district is the well-known region of western Pennsylvania, in Westmoreland and Fayette counties, extending from just south of Latrobe to Fairchance. The Greensburg, Irwin, Pittsburg, and Reynoldsville-Walston districts include the ovens near the towns which have given the names to these districts. The Upper Connellsville district, sometimes called the Latrobe district, is near the town of Latrobe.

The Allegheny Valley district may be said to have passed out of existence, as no coke has been made there during the last four years, and it is practically abandoned.

The statistics of coke production in Pennsylvania during 1900 and 1901 are presented, by districts, in the following tables:

Coke production in Pennsylvania in 1900, by districts.

District.	Establishments.	Ovens.		Coal used.	Coke produced.	Total value of coke at ovens.	Value of coke at ovens, per ton.	Yield of coal in coke.
		Built.	Building.					
				Short tons.	*Short tons.*			*Per cent.*
Allegheny Mountain	14	[a]1,341	0	876,440	557,184	$1,260,441	$2.26	63.6
Allegheny Valley	1	66	0	0	0	0	0	0
Broad Top	6	532	[d]232	179,088	113,448	230,580	2.03	63.3
Clearfield-Center	7	568	0	212,196	134,828	283,592	2.10	63.5
Connellsville	98	[b]20,981	686	14,946,659	10,020,907	22,383,432	2.23	67
Greensburg	5	680	280	331,305	196,709	442,704	2.25	59.4
Irwin	5	697	0	93,647	61,630	153,743	2.49	65.8
Lower Connellsville	12	2,033	1,112	579,928	385,909	792,886	2.05	66.5
Pittsburg	8	[c]1,641	0	862,610	570,678	1,418,382	2.48	66.1
Reynoldsville-Walston	7	2,010	0	1,115,923	625,553	1,347,869	2.15	56
Upper Connellsville	14	1,999	0	1,042,170	690,449	1,378,629	1.996	66.2
Total	177	32,548	2,310	20,239,966	13,357,295	29,692,258	2.22	66

[a] Includes 160 Otto-Hoffman and 8 Newton-Chambers ovens.

[b] Includes 50 Semet-Solvay ovens.

[c] Includes 120 Otto-Hoffman and 25 Semet-Solvay ovens.

[d] Otto-Hoffman ovens at Lebanon.

Coke production in Pennsylvania in 1901, by districts.

District.	Establishments.	Ovens.		Coal used.	Coke produced.	Total value of coke at ovens.	Value of coke at ovens, per ton.	Yield of coal in coke.
		Built.	Building.					
				Short tons.	*Short tons.*			*Per cent.*
Allegheny Mountain	[a]16	[b]1,378	0	864,133	548,076	$1,112,682	$2.03	63.4
Broad Top	6	571	[e]232	187,715	118,949	237,898	2.00	63.4
Clearfield-Center	8	636	0	134,913	86,242	157,648	1.828	63.9
Connellsville	96	[c]21,586	243	15,266,722	10,235,943	19,172,697	1.873	67
Greensburg	6	991	0	406,957	257,785	464,692	1.80	63.3
Irwin	6	750	0	30,699	19,977	32,562	1.63	65
Lower Connellsville	17	3,251	30	1,666,826	1,116,379	1,991,699	1.784	66.9
Pittsburg	10	[d]1,651	[f]227	1,266,947	813,478	1,690,614	2.078	64.2
Reynoldsville-Walston	7	2,010	0	1,059,107	589,577	1,171,878	1.988	55.7
Upper Connellsville	16	2,082	100	852,448	569,511	1,033,991	1.815	66.8
Total	188	34,906	832	21,736,467	14,355,917	27,066,361	1.885	66

[a] One establishment made coke in open ricks, not ovens.
[b] Includes 160 Otto-Hoffman and 8 Newton-Chambers ovens.
[c] Includes 50 Semet-Solvay ovens.
[d] Includes 120 Otto-Hoffman and 25 Semet-Solvay ovens.
[e] Otto-Hoffman ovens at Lebanon.
[f] Includes 212 Schniewind by-product ovens.

Allegheny Mountain district.—The coke ovens in the vicinity of Johnstown and those lying along the line of the Pennsylvania Railroad east of Blairsville, as well as the plants in Somerset County, are included in the Allegheny Mountain district. Among the Johnstown ovens are 160 Otto-Hoffman by-product ovens operated in connection with the Cambria Steel Company. The production of the district in 1901 was slightly less (9,108 tons) than in 1900. There were 16 establishments in the district in 1901, and of these, 4, with a total of 126 ovens, were idle. One establishment made 250 tons of coke in open ricks. There was a net gain of 37 in the total number of ovens in the district in 1901 as compared with 1900.

The statistics of the manufacture of coke in the Allegheny Mountain district from 1880 to 1901 are as follows:

Statistics of the manufacture of coke in the Allegheny Mountain district of Pennsylvania from 1880 to 1901, inclusive.

Year.	Establishments.	Ovens.		Coal used.	Coke produced.	Total value of coke at ovens.	Value of coke at ovens, per ton.	Yield of coal in coke.
		Built.	Building.					
				Short tons.	*Short tons.*			*Per cent.*
1880	8	291	0	201,345	127,525	$289,929	$2.27	63
1881	9	371	0	225,563	144,430	329,198	2.28	64
1882	10	481	0	284,544	179,580	377,286	2.10	63
1883	10	532	0	200,343	135,342	240,641	1.78	68
1884	12	614	0	241,459	156,290	203,213	1.30	65
1885	11	523	82	327,666	212,242	286,539	1.30	65
1886	10	579	14	351,070	227,369	374,013	1.64	64.8
1887	10	694	150	461,922	297,724	671,437	2.25	64.4
1888	12	950	145	521,047	335,689	479,845	1.43	64.4
1889	16	1,069	20	564,112	354,288	601,964	1.69	63.5
1890	16	1,171	0	633,974	402,514	730,048	1.81	63.5
1891	16	1,201	0	708,523	448,067	782,175	1.75	63
1892	16	1,260	0	724,903	448,522	775,927	1.73	61.9
1893	15	1,260	0	275,865	173,131	264,292	1.53	62.8
1894	15	1,253	0	92,965	58,823	71,161	1.21	63.3
1895	13	1,233	60	271,096	173,965	214,741	1.23	64
1896	13	[a] 1,188	0	408,827	266,473	349,373	1.31	65
1897	13	[a] 1,185	0	417,470	278,578	365,191	1.31	66.7
1898	13	[a] 1,158	[b] 100	572,568	378,410	511,202	1.35	66
1899	13	[c] 1,256	8	730,843	478,340	959,740	2.01	65.5
1900	14	[d] 1,341	0	876,440	557,184	1,260,441	2.26	63.6
1901	[e] 16	[d] 1,378	0	864,133	548,076	1,112,682	2.03	63.4

[a] Includes 60 Otto-Hoffman ovens.

[b] Otto-Hoffman ovens.

[c] Includes 160 Otto-Hoffman ovens.

[d] Includes 160 Otto-Hoffman and 8 Newton-Chambers ovens.

[e] One establishment made coke in open ricks.

Allegheny Valley district.—This district has never been of importance as a coke producer, the largest product being reported in 1887, when 44,621 tons of coke were made. No coke has been made in the district since 1897, and the last bank of ovens was abandoned last year.

Beaver district.—This district, like the Allegheny Valley district, has ceased to exist as a separate region. The ovens in Beaver County were abandoned in 1898, and since that time the statistics of production in Mercer County have been included with those of the Pittsburg district.

Blossburg district.—This district was at one time of considerable importance as a coke producer, but no coke has been made there since 1895. The ovens have been abandoned.

Broad Top district.—The ovens in Bedford and Huntington counties, which comprise what is known as the Broad Top coal field, are included in this district. The 232 new Otto-Hoffman ovens in process of construction at Lebanon by the Lackawanna Iron and Steel Company will be added to this district when operations are begun. In 1901, 39 new ovens were added to the equipment of the field, and the product was increased from 113,438 tons in 1900 to 118,949 tons in 1901. Of the 571 ovens in the district 132 were not operated last year.

The statistics of the manufacture of coke in the Broad Top district from 1880 to 1901 are shown in the following table:

Statistics of the manufacture of coke in the Broad Top district, Pennsylvania, from 1880 to 1901, inclusive.

Year.	Establishments.	Ovens.		Coal used.	Coke produced.	Total value of coke at ovens.	Value of coke at ovens, per ton.	Yield of coal in coke.
		Built.	Building.					
				Short tons.	*Short tons.*			*Per cent.*
1880	5	188	105	92,894	51,130	$123,748	$2.40	55
1881	5	188	105	111,593	66,560	167,074	2.51	59
1882	5	293	50	170,637	105,111	215,079	2.05	62
1883	5	343	110	220,932	147,154	271,692	1.84	66
1884	5	453	0	227,954	151,959	264,569	1.74	66
1885	5	537	0	190,836	112,073	185,656	1.65	58
1886	5	562	100	171,137	108,294	187,321	1.73	63.3
1887	5	581	0	262,730	164,535	347,061	2.11	62.6
1888	5	591	0	196,015	119,469	286,655	2.40	61
1889	5	589	0	152,090	91,256	186,718	2.05	60
1890	5	482	16	247,823	157,208	314,416	2.00	63
1891	5	448	0	146,008	90,728	197,048	2.17	62
1892	5	448	8	185,600	117,554	216,090	1.84	63.3
1893	5	456	14	136,069	86,752	150,196	1.73	63.8
1894	5	454	14	53,216	34,089	51,815	1.52	64
1895	5	460	0	133,276	85,842	150,224	1.75	64.4
1896	5	480	0	111,145	72,175	126,306	1.75	64.9
1897	5	491	15	106,706	66,949	107,430	1.60	62.7
1898	5	500	4	122,820	80,935	124,882	1.543	65.9
1899	5	519	3	161,196	107,258	197,895	1.84	66.5
1900	6	532	[a]232	179,088	113,448	230,580	2.03	63.3
1901	6	571	[a]232	187,715	118,949	237,898	2.00	63.4

[a] Otto-Hoffman ovens.

Clearfield-Center district.—This district derived its name from the two counties, Clearfield and Center, which comprise it. During 1901, 50 ovens in Elk County were completed and these have been added to the plants of the district. Notwithstanding this addition and that of 18 other new ovens, the coke production in 1901 decreased from 134,828 tons in 1900 to 86,242 tons in 1901. Eighty ovens in the district were idle all of last year.

The statistics of the manufacture of coke in the Clearfield-Center district for the years 1880 to 1901 are as follows:

Statistics of the manufacture of coke in the Clearfield-Center district, Pennsylvania, from 1880 to 1901, inclusive.

Year.	Establishments.	Ovens.		Coal used.	Coke produced.	Total value of coke at ovens.	Value of coke at ovens, per ton.	Yield of coal in coke.
		Built.	Building.					
				Short tons.	*Short tons.*			*Per cent.*
1880	1	0	0	200	100	$200	$2.00	50
1881	2	50	0	20,025	13,350	22,695	1.70	67
1882	1	50	0	25,000	17,160	27,406	1.60	69
1883	1	60	0	26,500	18,696	28,844	1.50	71
1884	1	60	0	33,000	23,431	32,849	1.40	71
1885	2	245	0	69,720	48,103	70,331	1.46	69
1886	3	299	20	84,870	55,810	94,877	1.70	66
1887	6	523	10	154,566	97,852	198,095	2.02	63.3
1888	6	601	0	172,999	115,338	174,220	1.51	66.6
1889	6	671	0	195,473	120,734	215,112	1.78	61.7
1890	7	701	0	331,104	212,286	391,957	1.85	64
1891	7	666	0	293,542	183,911	339,082	1.84	63
1892	7	731	0	231,357	147,819	264,422	1.79	63.9
1893	8	695	0	155,119	98,650	171,482	1.74	63.6
1894	8	694	0	61,428	38,825	51,482	1.33	63
1895	8	695	0	155,088	99,469	131,188	1.32	64
1896	7	666	0	183,056	118,155	164,266	1.39	64.5
1897	7	668	0	230,395	153,517	197,139	1.28	66
1898	7	668	0	215,208	137,265	195,836	1.43	63.8
1899	6	450	50	198,110	130,965	234,527	1.79	66.1
1900	7	568	0	212,196	134,828	283,592	2.10	63.5
1901	8	[a]636	0	134,913	86,242	157,648	1.828	63.9

[a] Includes 50 ovens in Elk County,

Connellsville district.—Within the counties of Fayette and Westmoreland is located the greatest coke-producing basin in the world. This district produces approximately 50 per cent of the total output of the United States, and in 1901 produced 70 per cent of the total output of Pennsylvania. The production of the district in 1901 amounted to 10,235,943 short tons, an increase of 215,036 short tons over 1900. The production last year, however, was still a little short of the maximum output obtained in 1899, when the product amounted to 10,390,335 short tons. The value of the product in 1901 as compared with that in 1900 shows a decline from $22,383,482 to $19,172,697, a loss of $3,210,735. This loss in value was not due to any depreciation in the trade during 1901, as the demand was good and prices were firm throughout the entire year. During the spring of 1900, however, prices for Connellsville coke were abnormally high, and even at the extreme figures reached coke was for a time hard to obtain. A temporary slump in the iron trade in the summer of 1900 brought prices to a more rational basis and the lowest prices for the year were reached in December. With the opening of 1900 prices became steady. January opened with an active demand and with the usual cry of a shortage of car supply. During February the production continued with unabated activity and the industry was practically upon a boom foundation. According to the reports of the Connellsville Courier the month of March eclipsed all records for the district, it being claimed that shortage of cars alone kept the output of the region below 250,000 tons per week, which would have been at the rate of 12,500,000 tons per year. Naturally with such a brisk demand prices were firm, with an advancing tendency. There was no cessation in the upward tendency until the latter part of May or early in June, when the usual summer slowness and slackened demand were observed. But this was short-lived, as before the end of June demand again became active and continued so throughout July. In August the strike of the Amalgamated Association of Iron, Steel, and Tin Plate Workers caused a let up in the demand, and in the latter part of August and the first of September a number of ovens were put out of blast. With the settlement of the strike in the middle of September activity was again resumed and continued throughout the year, although shipments were much hampered during October, November, and December by the insufficient car supplies.

The year 1901 may be said to have been one of the most satisfactory that the Connellsville region has experienced in its entire history. Prices, without being extravagantly high, were firm and showed a general rising tendency throughout the year. Furnace coke, which was quoted at $1.75 in January, advanced to $2 in April and reached as high as $2.25 before the close of the year. Foundry and crushed coke ranged from 25 to 50 cents higher than furnace. The average price of all the coke produced in the Connellsville region in 1901 was $1.873, a figure exceeded only twice since 1880.

The following are the statistics of the manufacture of coke in the Connellsville region from 1880 to 1901:

Statistics of the manufacture of coke in the Connellsville region, Pennsylvania, from 1880 to 1901, inclusive.

Year.	Establishments.	Ovens.		Coal used.	Coke produced.	Total value of coke at ovens.	Value of coke at ovens, per ton.	Yield of coal in coke.
		Built.	Building.					
				Short tons.	*Short tons.*			*Per cent.*
1880	67	7,211	731	3,367,856	2,205,946	$3,948,643	$1.79	65.5
1881	70	8,208	654	4,018,782	2,639,002	4,301,573	1.63	65.7
1882	72	9,283	592	4,628,736	3,043,394	4,473,789	1.47	65.8
1883	74	10,176	101	5,355,380	3,552,402	4,049,738	1.14	66.3
1884	76	10,543	200	4,829,054	3,192,105	3,607,078	1.13	66.1
1885	68	10,471	48	4,683,831	3,096,012	3,776,388	1.22	66.1
1886	36	11,324	1,895	6.305,460	4,180,521	5,701,086	1.36	66.3
1887	73	11,923	98	6,182,846	4,146,989	7,437,669	1.79	67
1888	38	12,818	1,320	7,191,708	4,955,553	5,884,081	1.19	69
1889	29	14,458	430	8,832,371	5,930,428	7,974,633	1.34	67
1890	28	15,865	30	9,748,449	6,464,156	11,537,370	1.94	66.3
1891	33	17,551	0	7,083.705	4,760,665	8,903,454	1.87	67
1892	31	17,309	0	9,389,549	6,329,452	11,598,407	1.83	67.4
1893	28	17,504	5	7,095,491	4,805,623	7,141,031	1.49	67.7
1894	29	17,829	0	7,656,169	5,192,080	5,405,691	1.04	67.8
1895	29	18,028	80	12,174,597	8,181,179	10,122,458	1.237	67.2
1896	88	[a]18,347	0	8,107,536	5,462,490	10,018,946	1.834	67.4
1897	86	[a]18,467	92	10,243,690	6,860,826	10,662,428	1.55	67
1898	88	[a]18,927	20	12,454,969	8,315,350	12,626,292	1.518	66.8
1899	86	[a]19,294	792	14,974,018	10,390,335	17,075,411	1.64	69.4
1900	98	[a]20,981	686	14,946,659	10,020,907	22,383,432	2.23	67
1901	96	[a]21,586	243	15,266,722	10,235,943	19,172,697	1.873	67

[a] Includes 50 Semet-Solvay by-product ovens.

The following table, compiled by the Connellsville Courier, of Connellsville, Pa., shows the shipments of coke from the Connellsville region in 1901, by months, in cars and tons, with the average number of cars shipped each working day in the month:

Shipments of coke from the Connellsville region in 1901, by months.

Month.	Cars.	Daily average.	Tons.
January	46,873	1,736	989,367
February	44,186	1,841	939,756
March	53,351	2,052	1,150,734
April	49,376	1,899	1,070,708
May	49,995	1,852	1,084,458
June	49,302	1,972	1,075,000
July	48,810	1,808	1,046,996
August	50,742	1,879	1,099,417
September	46,537	1,861	1,011,439
October	51,636	1,912	1,128,183
November	48,128	1,851	1,070,204
December	42,105	1,620	943,687
Total	581,041	1,856	12,609,949

The monthly shipments of coke from this region in the years 1897 to 1901, as reported by the Courier, are given in the following table:

Monthly shipments of coke from the Connellsville region in the years 1897 to 1901, inclusive.

[Short tons.]

Month.	1897.	1898.	1899.	1900.	1901.
January	485, 624	727, 739	779, 792	1, 001, 882	989, 367
February	466, 206	667, 287	699, 474	910, 729	939, 756
March	521, 484	744, 987	839, 763	1, 044, 588	1, 150, 734
April	493, 027	701, 317	831, 964	982, 551	1, 070, 708
May	501, 857	680, 754	804, 023	934, 186	1, 084, 458
June	500, 483	636, 877	837, 123	872, 316	1, 075, 000
July	583, 867	646, 065	883, 735	732, 981	1, 046, 996
August	562, 703	662, 880	889, 078	698, 065	1, 099, 417
September	625, 902	644, 422	813, 190	673, 336	1, 011, 439
October	737, 498	731, 602	874, 357	734, 748	1, 128, 183
November	700, 352	844, 907	935, 608	751, 443	1, 070, 204
December	736, 049	771, 275	941, 657	829, 409	943, 687
Total	6, 915, 052	8, 460, 112	10, 129, 764	10, 166, 234	12, 609, 949

The shipments, as reported by the Courier in 1901, are considerably in excess of the production reported to the Geological Survey. In previous years these figures have not shown any wide variation. The Courier also publishes each year a statement as to the number of cars shipped from the region to the three chief points of distribution. The figures for 1899, 1900, and 1901, as reported to the Courier, are shown in the following table:

Monthly shipments of coke from the Connellsville region, in cars, to points of distribution during 1899, 1900, and 1901.

[Car loads.]

Month.	Pittsburg.	West.	East.	Total.	Daily average.
1899.					
January	13, 826	20, 559	5, 935	40, 320	1, 550
February	12, 402	18, 694	5, 201	36, 297	1, 512
March	13, 886	22, 741	6, 975	43, 602	1, 615
April	13, 738	22, 699	6, 964	43, 401	1, 736
May	14, 154	20, 850	6, 651	41, 655	1, 543
June	13, 905	22, 194	7, 245	43, 344	1, 667
July	15, 052	22, 674	8, 293	46, 019	1, 770
August	13, 348	25, 118	8, 127	46, 593	1, 726
September	13, 852	21, 708	6, 827	42, 387	1, 630
October	14, 753	22, 895	7, 452	45, 100	1, 735
November	13, 925	25, 542	8, 071	47, 538	1, 828
December	13, 741	25, 258	7, 948	46, 947	1, 805
Total	166, 582	270, 932	85, 689	523, 203	1, 676

Monthly shipments of coke from the Connellsville region, in cars, to points of distribution during 1899, 1900, and 1901—Continued.

[Car loads.]

Month.	Pittsburg.	West.	East.	Total.	Daily average.
1900.					
January	15,366	26,271	9,302	50,939	1,887
February	14.519	24,763	8,607	47,889	1,995
March	15,614	28,010	8,869	52,493	1,944
April	12,917	27,128	9,693	49,738	1,990
May	12,338	24,066	10,006	46,410	1,720
June	12,462	21,935	8,574	42,971	1,653
July	12,087	17,359	5,990	35,436	1,363
August	12,884	14,902	6,404	34,190	1,266
September	12,310	15,260	5,412	32,982	1,319
October	12,947	16,282	6,451	35,680	1,322
November	13,712	16,145	6,163	36,020	1,385
December	14,292	18,140	7,230	39,662	1,586
Total	161,448	250,261	92,701	504,410	1,619
1901.					
January	16,393	20,601	9,879	46,873	1,736
February	14,101	20,509	9,576	44,186	1,841
March	16,235	26,786	10,330	53,351	2,052
April	15,170	24,306	9,900	49,376	1,899
May	15,152	25,653	9,190	49,995	1,852
June	14,969	25,456	8,877	49,302	1,972
July	15,073	24,692	9,045	48,810	1,808
August	16,719	24,670	9,353	50,742	1,879
September	16,118	22,619	7,800	46,537	1,861
October	17,114	25,129	9,393	51,636	1,912
November	15,227	25,055	7,856	48,138	1,851
December	14,365	21,380	6,360	42,105	1,620
Total	186,636	286,856	107,559	581,051	1,857

The total shipments, in cars, for the last fourteen years were as follows:

Total and daily average shipments, in cars, from 1888 to 1901, inclusive.

Year.	Daily average.	Total cars.	Year.	Daily average.	Total cars.
1888	905	282,441	1895	1,410	441,243
1889	1,046	326,220	1896	920	289,137
1890	1,147	355,070	1897	1,181	367,383
1891	884	274,000	1898	1,415	441,249
1892	1,106	347,012	1899	1,676	523,203
1893	874	270,930	1900	1,619	504,410
1894	900	281,677	1901	1,857	581,051

The following table shows the prices prevailing throughout the year 1901:

Average monthly prices of Connellsville coke, per short ton, during 1901.

Month.	Furnace.	Foundry.	Crushed.
January	$1.75	$2.00 to $2.25	$2.25 to $2.50
February	1.75	2.25	2.50
March	$1.75 to 2.00	2.50	2.50
April	2.00	2.50	....
May	2.00	2.50	....
June	1.75 to 2.00	2.25 to 2.50	....
July	1.75 to 2.00	2.25 to 2.50	....
August	1.75 to 2.00	2.25 to 2.50	....
September	1.75 to 2.00	2.25 to 2.50	....
October	1.75 to 2.00	2.25 to 2.50	....
November	1.85 to 2.00	2.25 to 2.50	....
December	2.10 to 2.25	2.35 to 2.50	....

How the above compares with the prices for the corresponding months in 1900 may be seen below:

Average monthly prices of Connellsville coke, per short ton, during 1900.

Month.	Furnace.	Foundry.	Crushed.
January	$2.75 to $3.50	$3.00 to $4.00	....
February	2.75 to 3.50	3.00 to 4.00	....
March	3.25 to 4.25	3.75 to 4.50	....
April	3.25 to 4.25	3.25 to 4.50	....
May	3.00 to 3.25	3.00 to 3.50	....
June	2.50 to 3.00	3.00 to 3.25	....
July	2.00 to 2.50	2.75 to 3.00	$3.00 to $3.25
August	2.00	2.75	3.00 to 3.25
September	2.00	2.25 to 2.50	2.75 to 3.00
October	2.00	2.25 to 2.50	....
November	2.00	2.25 to 2.50	....
December	1.75 to 2.00	2.25 to 2.50	....

Greensburg district.—This district, which includes the ovens in the vicinity of the town of Greensburg, is of growing importance, the production having increased steadily since 1894. In that year there were 118 ovens in existence. In 1901 the number of ovens was 991. The production in the same time had increased from 15,872 to 257,785 short tons. The production last year was more than 30 per cent larger than that of 1900. There were 6 establishments in the district in 1901, all of which were operated.

Statistics of the manufacture of coke in the Greensburg district, Pennsylvania, from 1889 to 1901, inclusive.

Year.	Establishments.	Ovens.		Coal used.	Coke produced.	Total value of coke at ovens.	Value of coke at ovens, per ton.	Yield of coal in coke.
		Built.	Building.					
				Short tons.	*Short tons.*			*Per cent.*
1889	2	50	16	32,070	20,459	$21,523	$1.05	63.8
1890	2	58	0	44,000	30,261	44,290	1.46	68.7
1891	2	58	0	38,188	22,441	36,627	1.63	59
1892	2	58	0	15,005	9,037	13,173	1.46	60.2
1893	3	88	0	29,983	18,393	26,303	1.43	61
1894	3	118	0	27,290	15,872	18,413	1.16	58.2
1895	3	118	0	31,300	20,309	22,340	1.10	65
1896	3	178	0	36,963	24,642	30,928	1.255	66
1897	3	178	0	81,927	52,495	65,619	1.25	64
1898	3	218	0	112,487	64,295	96,443	1.50	57
1899	4	307	240	173,811	110,594	247,421	2.24	63.6
1900	5	680	280	331,305	196,709	442,704	2.25	59.4
1901	6	991	0	406,957	257,785	464,692	1.80	63.3

Irwin district.—This district includes the ovens situated near the town of Irwin and also those located in what may be termed the Irwin basin, on the Youghiogheny River. Prior to 1901 most of the coke in the district was produced by the Carnegie Steel Company at Larimer and Douglas. These ovens were not operated in 1901. Of the 6 establishments, 750 ovens, in the district, 3 establishments, 544 ovens, were not operated during the year. The ovens which were operated were those controlled by the Pittsburg Coal Company, which utilized the slack coal produced at the Smithton, Port Royal, and Euclid plants.

Statistics of the manufacture of coke in the Irwin district, Pennsylvania, from 1889 to 1901, inclusive.

Year.	Establishments.	Ovens.		Coal used.	Coke produced.	Total value of coke at ovens.	Value of coke at ovens, per ton.	Yield of coal in coke.
		Built.	Building.					
				Short tons.	*Short tons.*			*Per cent.*
1889	4	696	0	373,913	243,448	$351,304	$1.44	65
1890	4	661	0	270,476	172,329	256,458	1.49	63.7
1891	4	696	0	323,099	197,082	266,061	1.35	61
1892	4	669	0	328,193	202,809	284,029	1.40	61.8
1893	5	725	0	238,832	150,463	175,609	1.30	63
1894	5	725	0	176,318	110,995	119,764	1.08	63
1895	5	725	0	166,124	103,872	105,609	1.017	62.5
1896	5	696	0	279,104	175,916	275,518	1.566	63
1897	5	696	0	207,704	136,663	189,869	1.39	65.8
1898	5	696	0	332,368	183,176	239,583	1.308	55
1899	5	697	0	223,457	133,085	197,694	1.48	59.6
1900	5	697	0	93,647	61,630	153,743	2.49	65.8
1901	6	750	0	30,699	19,977	32,562	1.63	65

Lower Connellsville district.—As previously stated, this district, locally known as Klondike, is an extension of the Connellsville basin southward. The first ovens in this district were begun in 1899 and completed in 1900, the first coke being drawn on June 1 of that year. By the close of 1900 there were 2,033 ovens completed in the district. The product for that year amounted to 385,909 short tons. An increase of 60 per cent in the number of ovens was noted in the statistics for 1901, while the product increased nearly 200 per cent, to 1,116,379 short tons.

The record of the district for the two years during which it has been in existence is shown in the following table:

Statistics of manufacture of coke in the Lower Connellsville district in 1900 and 1901.

Year.	Establishments.	Ovens.		Coal used.	Coke produced.	Total value of coke at ovens.	Value of coke at ovens, per ton.	Yield of coal in coke.
		Built.	Building.					
				Short tons.	*Short tons.*			*Per cent.*
1900	12	2,033	1,112	579,928	385,909	$792,886	$2.05	66.5
1901	17	3,251	30	1,666,826	1,116,379	1,991,699	1.784	66.9

Pittsburg district.—A large proportion of the coke made in the Pittsburg district is from slack coal obtained from the mines along the slack-water navigation of the Monongahela River, brought to Pittsburg in barges. Some of the run-of-mine coal is also brought from the fourth pool of the Monongahela River for coking at Pittsburg. The production of the last few years has included also the 120 Otto-Hoffman ovens located at Glassport, and 25 Semet-Solvay ovens located at Sharon, in Mercer County. The latter ovens were formerly included in the Beaver district. The production in 1901 was a little less than that of the preceding year. There were 10 establishments, with a total of 1,651 ovens, in the district in 1901. Of these, 4 establishments, with a total of 94 ovens, were idle during the year. Of the 227 ovens noted as building at the close of 1901, 212 were Schniewind by-product ovens, building for the Sharon Coke Company at Sharon.

The statistics of the manufacture of coke in the Pittsburg district, Pennsylvania, for the years 1880 to 1901, inclusive, are stated in the following table:

Statistics of the manufacture of coke in the Pittsburg district, Pennsylvania, from 1880 to 1901, inclusive.

Year.	Establishments.	Ovens.		Coal used.	Coke produced.	Total value of coke at ovens.	Value of coke at ovens, per ton.	Yield of coal in coke.
		Built.	Building.					
				Short tons.	*Short tons.*			*Per cent.*
1880	21	534	0	194,393	105,974	$254,500	$2.40	55
1881	21	538	0	178,509	96,310	206,965	2.15	54
1882	21	557	0	114,956	64,779	134,378	2.07	56.3
1883	20	542	0	119,310	66,820	126,020	1.89	56
1884	20	535	0	97,367	53,857	99,911	1.87	55
1885	17	416	4	91,101	46,930	72,509	1.55	51.5
1886	18	730	0	228,874	138,646	221,617	1.88	60.6
1887	20	880	235	366,184	177,097	315,546	1.78	48.4
1888	22	980	0	428,899	264,156	350,818	1.33	62
1889	17	600	21	233,571	141,324	283,402	2.00	60.5
1890	14	541	0	149,230	93,984	171,465	1.82	63
1891	13	590	11	154,054	94,160	201,458	2.14	61
1892	15	725	261	292,357	176,365	376,613	2.14	60.3
1893	10	885	0	357,400	216,268	438,801	2.03	60.5
1894	9	779	104	371,569	227,100	351,825	1.55	61
1895	9	973	0	452,845	232,529	547,284	2.35	51.3
1896	11	1,264	[a] 120	583,984	368,070	941,076	2.56	63
1897	9	[b] 1,233	200	832,505	548,981	864,326	1.57	66
1898	10	[c] 1,100	168	836,948	552,742	899,537	1.627	66
1899	10	[c] 1,312	505	954,028	644,467	1,189,117	1.84	67.6
1900	[d] 8	[c] 1,641	0	862,610	570,678	1,418,382	2.48	66.1
1901	[e] 10	[c] 1,651	[f] 227	1,266,947	813,478	1,690,614	2.078	64.2

[a] Otto-Hoffman by-product ovens.

[b] Includes 120 Otto-Hoffman ovens.

[c] Includes 120 Otto-Hoffman and 25 Semet-Solvay ovens.

[d] Includes one establishment in Mercer County.

[e] Includes two establishments in Mercer County and one in Armstrong County.

[f] Includes 212 Schniewind ovens.

Reynoldsville-Walston district.—This district includes all of the ovens on the Rochester and Pittsburg Railroad, as well as those on the Low Grade Division of the Allegheny Valley Railway, and the mines on the New York, Erie and Western Railway. The production in 1901 was 589,577 short tons, as compared with 625,553 short tons in 1900. The production in these two years was about the normal output of the district.

The following are the statistics of the manufacture of coke in the Reynoldsville-Walston district for the years 1880 to 1901:

Statistics of the manufacture of coke in the Reynoldsville-Walston district, Pennsylvania, from 1880 to 1901, inclusive.

Year.	Establishments.	Ovens.		Coal used.	Coke produced.	Total value of coke at ovens.	Value of coke at ovens, per ton.	Yield of coal in coke.
		Built.	Building.					
				Short tons.	*Short tons.*			*Per cent.*
1880	3	117	0	45,055	28,090	$46,359	$1.65	62
1881	4	125	2	99,489	44,260	80,785	1.85	44
1882	5	177	0	87,314	44,709	80,339	1.80	51
1883	6	229	0	76,580	37,044	65,584	1.77	48
1884	7	321	0	159,151	78,646	113,155	1.44	49
1885	8	600	143	183,806	114,409	153,795	1.35	62
1886	9	783	500	271,037	161,828	217,834	1.35	59.7
1887	11	1,492	134	507,320	316,107	592,728	1.88	62.3
1888	9	1,636	100	404,346	253,662	320,203	1.26	62.7
1889	8	1,747	0	514,461	313,011	436,857	1.40	60.8
1890	8	1,737	0	652,966	406,184	771,996	1.90	62
1891	7	1,747	0	769,100	470,479	744,098	1.58	61
1892	8	1,734	0	683,539	425,250	743,227	1.75	62.2
1893	8	1,755	0	562,033	339,314	586,212	1.73	60.4
1894	8	1,755	0	336,554	207,238	297,596	1.44	61.6
1895	8	1,637	0	504,092	296,820	357,266	1.20	58.9
1896 [a]	7	1,852	34	770,104	445,998	673,625	1.51	57.9
1897 [a]	6	1,980	0	810,808	491,267	759,609	1.55	60.6
1898 [a]	5	1,942	0	1,022,196	600,084	846,121	1.41	58.7
1899 [a]	6	1,779	0	1,581,164	972 933	1,793,807	1.84	61.5
1900	7	2,010	0	1,115,923	625,553	1,347,869	2.15	56
1901	7	2,010	0	1,059,107	589,577	1,171,878	1.988	55.7

[a] Includes coal used, coke produced, and its value in New York; also in Massachusetts for 1899.

Upper Connellsville district.—This district includes that portion of the Connellsville trough or basin which lies north of a point a short distance south of the town of Latrobe. The coal of this vicinity differs somewhat from that of the basin proper, so that in addition to its geographic position there is another reason for separating the production from that of the Connellsville district. There were 16 establishments reported for the district in 1900. One of these, having 43 ovens, was idle. Another had 100 ovens under construction, but none of them were completed before the close of the year. The production of 569,511 short tons was from 14 establishments having a total of 2,039 ovens. As compared with 1900 there was a decrease of 120,938 short tons.

The following are the statistics of the manufacture of coke in the Upper Connellsville region for the years 1880 to 1901:

Statistics of the manufacture of coke in the Upper Connellsville district, Pennsylvania, from 1880 to 1901, inclusive.

Year	Establishments.	Ovens.		Coal used.	Coke produced.	Total value of coke at ovens.	Value of coke at ovens, per ton.	Yield of coal in coke.
		Built.	Building.					
				Short tons.	*Short tons.*			*Per cent.*
1880	8	757	0	319,927	229,433	$397,945	$1.73	72
1881	10	986	0	588,924	343,728	548,362	1.60	58
1882	11	1,118	0	650,174	375,918	536,503	1.48	58
1883	11	1,118	0	668,882	389,053	422,174	1.08	58
1884	11	1,118	0	496,894	294,477	311,665	1.06	59
1885	11	1,168	40	555,735	319,297	346,168	1.08	57
1886	12	1,337	29	691,331	442,968	572,073	1.29	64.1
1887	16	1,442	87	717,274	470,233	840,144	1.79	65.6
1888	16	1,977	0	657,966	441,966	617,189	1.40	67
1889	13	1,568	80	635,220	417,263	609,828	1.46	65.6
1890	14	1,569	28	889,277	577,246	1,008,102	1.75	64.9
1891	14	1,724	0	1,000,184	649,316	1,111,056	1.71	65
1892	14	1,843	0	706,171	451,975	691,323	1.53	64
1893	14	1,843	0	499,809	320,793	447,090	1.39	64
1894	14	1,843	0	279,971	176,799	212,595	1.20	63
1895	14	1,849	30	319,285	208,158	251,892	1.21	65
1896	14	1,863	0	617,601	406,112	570,687	1.405	65.7
1897	14	1,863	0	556,941	345,372	444,709	1.29	62
1898	13	1,832	0	638,277	403,045	538,609	1.34	63
1899	13	1,861	68	933,792	609,893	986,298	1.62	65.3
1900	14	1,999	0	1,042,170	690,449	1,378,629	1.996	66.2
1901	16	2,082	100	852,448	569,511	1,033,991	1.815	66.8

TENNESSEE.

The coke product of Tennessee is consumed principally in the iron furnaces in the vicinity of Chattanooga and other points in the eastern part of the State. The production in 1901 amounted to 404,017 short tons, valued at $952,782, as compared with 475,432 short tons, worth $1,269,555, in 1900. The decrease in production amounted to 71,415 short tons, or about 15 per cent. The value fell off $316,773, or practically 25 per cent. At the close of 1901 there were 14 establishments having a total of 2,135 ovens in the State, an increase of 28 in the number of ovens over 1900, while the number of establishments remained the same. Of these, 2 establishments, having a total of 131 ovens, were idle during the year.

During 1899 it was reported that an experimental plant of three so-called Keneval ovens was built in Knoxville, but no later information in regard to it has been received.

The following are the statistics of the manufacture of coke in Tennessee for the years 1880 to 1901:

Statistics of manufacture of coke in Tennessee from 1880 to 1901, inclusive.

Year.	Establishments.	Ovens.		Coal used.	Coke produced.	Total value of coke at ovens.	Value of coke at ovens, per ton.	Yield of coal in coke.
		Built.	Building.					
				Short tons.	*Short tons.*			*Per cent.*
1880	6	656	68	217,656	130,609	$316,607	$2.42	60
1881	6	724	84	241,644	143,853	342,585	2.38	60
1882	8	861	14	313,537	187,695	472,505	2.52	60
1883	11	992	10	330,961	203,691	459,126	2.25	62
1884	*a* 13	1,105	175	348,295	219,723	428,870	1.95	63
1885	12	1,387	36	412,538	218,842	398,459	1.82	53
1886	12	1,485	126	621,669	368,139	687,865	1.87	59
1887	11	1,560	165	655,857	396,979	870,900	2.19	61
1888	11	1,634	84	630,099	385,693	490,491	1.27	61
1889	12	1,639	40	626,016	359,710	731,496	2.03	57
1890	11	1,664	292	600,387	348,728	684,116	1.96	58
1891	11	1,995	0	623,177	634,318	701,803	1.93	58
1892	11	1,941	0	600,126	354,096	724,106	2.05	59
1893	11	1,942	0	449,511	265,777	491,523	1.85	61
1894	11	1,860	0	516,802	292,646	480,124	1.64	56.6
1895	12	1,903	0	684,655	396,790	754,926	1.90	57.9
1896	15	1,861	100	600,379	339,202	624,011	1.84	56.5
1897	15	1,948	0	667,996	368,769	667,656	1.81	55
1898	15	1,949	40	722,356	394,545	642,920	1.63	54.6
1899	14	2,040	62	779,995	435,308	850,686	1.95	55.8
1900	14	2,107	340	854,789	475,432	1,269,555	2.67	55.6
1901	14	2,135	258	739,246	404,017	952,782	2.358	54.6

a One establishment made coke in pits.

The character of the coal used in the manufacture of coke in Tennessee since 1890 is shown in the following table:

Character of coal used in the manufacture of coke in Tennessee since 1890.

[Short tons.]

Year.	Run of mine.		Slack.		Total.
	Unwashed.	Washed.	Unwashed.	Washed.	
1890	255,359	0	273,028	72,000	600,387
1891	184,556	0	377,914	60,707	623,177
1892	176,453	15,000	367,827	40,846	600,126
1893	179,126	0	137,483	132,902	449,511
1894	166,990	61,841	149,958	138,013	516,802
1895	96,744	59,284	285,906	242,721	684,655
1896	0	206,319	219,231	174,829	600,379
1897	36,485	400,166	119,755	111,590	667,996
1898	37,217	306,969	122,756	255,414	722,356
1899	140,804	267,105	31,805	340,236	779,995
1900	150,697	349,448	24,122	330,522	854,789
1901	224,723	282,129	34,088	198,306	739,246

UTAH.

As there is but one establishment in the State of Utah engaged in the manufacture of coke, the statistics of production have been included with those of Colorado. The coals in this State are practically identical in character with those of western Colorado.

VIRGINIA.

The increase in the coke production in Virginia during 1901, as compared with the production of the preceding year, was larger than that of any other State in the Union except Pennsylvania. In the percentage of increase it exceeded all other States with the exception of Ohio and Washington, but in both of these latter States the amount of production was comparatively small. Virginia's product in 1901 amounted to 907,130 short tons, as compared with 685,156 short tons in 1900, an increase of 221,974 tons, or 32.4 per cent. Notwithstanding this large increase in production, the value of the product in 1901 exceeded that of the preceding year by only $19,114, the average price having declined from $2.137 to $1.635. As in the two preceding years, the increases in production in 1901 were from the active developments which have been carried on in Wise County, along the Clinch River division of the Norfolk and Western Railroad. The number of ovens in the State was increased from 2,331 in 1900 to 2,775 in 1901. These included 60 Newton-Chambers ovens at Pocahontas, 52 of which were operated during 1901. Of the total number of ovens in the State, 1,966 were in the Clinch River district. There are two plants in the State, one at Covington and the other at Lowmoor, the coal for which is drawn from the New River district in West Virginia. The coal for the Pocahontas ovens is obtained from mines which extend beyond the boundary between Virginia and West Virginia, and the greater part of the coal product belongs to the latter State. The openings of the mines, however, are in Virginia, and it has been customary to credit all the coal product, as well as the coke, to that State. The Wise County coke is made entirely from coal mined in Virginia. About 80 per cent of the total coke product of the State is now obtained from the ovens in Wise County.

The following are the statistics of the manufacture of coke in Virginia from 1883 to 1901:

Statistics of the manufacture of coke in Virginia from 1883 to 1901, inclusive.

Year.	Establishments.	Ovens.		Coal used.	Coke produced.	Total value of coke at ovens.	Value of coke at ovens, per ton.	Yield of coal in coke.
		Built.	Building.					
				Short tons.	*Short tons.*			*Per cent.*
1883	1	200	0	39,000	25,340	$44,345	$1.75	65
1884	1	200	0	99,000	63,600	111,300	1.75	64.3
1885	1	200	0	81,899	49,139	85,993	1.75	60
1886	2	350	100	200,018	122,352	305,880	2.50	61.2
1887	2	350	300	235,841	166,947	417,368	2.50	70.8
1888	2	550	0	230,529	140,199	260,000	1.74	64.7
1889	2	550	250	238,793	146,528	325,861	2.22	61
1890	2	550	250	251,683	165,847	278,724	1.68	66
1891	2	550	250	285,113	167,516	265,107	1.58	58.8
1892	2	594	206	226,517	147,912	322,486	2.18	65.3
1893	2	594	206	194,059	125,092	282,898	2.26	64.5
1894	2	736	100	280,524	180,091	295,747	1.64	64.2
1895	5	832	350	410,737	244,738	322,564	1.32	59.6
1896	7	1,138	101	454,964	268,081	404,573	1.509	58.9
1897	6	1,453	110	574,542	354,067	495,864	1.40	61.6
1898	6	[a]1,564	0	852,972	531,161	699,781	1.317	62
1899	6	[a]1,588	429	994,635	618,707	1,071,284	1.73	62.2
1900	7	[a]2,331	300	1,083,827	685,156	1,464,556	2.137	63.2
1901	7	[a]2,775	0	1,400,231	907,130	1,483,670	1.635	64.7

[a] Includes 60 Newton-Chambers by-product ovens, of which 56 were operated in 1900 and 52 in 1901.

None of the coal made into coke in Virginia was washed before coking in either 1900 or 1901. Sixty-two per cent of the coal used in 1901 was run-of-mine and 38 per cent was slack, as compared with 57 per cent run-of-mine and 43 per cent slack used in 1900.

The character of the coal used in the manufacture of coke in Virginia since 1890 is shown in the following table:

Character of coal used in the manufacture of coke in Virginia since 1890.

[Short tons.]

Year.	Run of mine.		Slack.		Total.
	Unwashed.	Washed.	Unwashed.	Washed.	
1890	98,215	0	153,468	0	251,683
1891	107,498	0	177,615	0	285,113
1892	106,010	0	120,507	0	226,517
1893	107,498	0	86,561	0	194,059
1894	103,874	0	176,650	0	280,524
1895	114,802	0	295 935	0	410,737
1896	70,756	0	370,624	13,584	454,964
1897	286,158	0	227,363	61,021	574,542
1898	405,399	0	237,474	210,099	852,972
1899	612,267	0	225,118	157,250	994,635
1900	620,207	0	463,620	0	1,083,827
1901	869,203	0	531,028	0	1,400,231

WASHINGTON.

Washington is the only one of the Pacific coast States producing coal of a quality suitable for the manufacture of coke. The operations are not of special importance, particularly when they are considered with the output of other coke-producing States, but they are of interest as establishing the fact that it is possible to produce a metallurgical coke from the Washington coals. An incentive to a greater development of the coke-making industry has been given by the construction of smelters on Puget Sound. As a result of this the production of coke in the State increased from 33,387 short tons in 1900 to 49,197 short tons in 1901, a gain of 15,810 tons, or 47.3 per cent. It will be observed, also, that there was an advance in price for Washington coke and that the total value increased practically 50 per cent, from $160,165 to $239,028. In 1901 two new establishments were added, and one of these, with 58 ovens, began producing coke. Another, the Carbon Hill Coal Company, began the construction of 52 ovens, but they were not completed before the beginning of 1902. The Wilkeson Coal and Coke Company is doubling its former plant of 50 ovens.

The coke industry in Washington began in 1884, since which time the statistical production has been as follows:

Statistics of the production of coke in Washington from 1884 to 1901, inclusive.

Year.	Establishments.	Ovens.		Coal used.	Coke produced.	Total value of coke at ovens.	Value of coke at ovens, per ton.	Yield of coal in coke.
		Built.	Building.					
				Short tons.	*Short tons.*			*Per cent.*
1884	1	0	0	700	400	$1,900	$4.75	57.5
1885	1	2	0	544	311	1,477	4.75	57
1886	1	11	21	1,400	825	4,125	5.00	58.9
1887	1	30	0	22,500	14,625	102,375	7.00	65
1888	1	30	100	0	0	0	0	0
1889	1	30	0	6,983	3,841	30,728	8.00	55
1890	2	30	80	9,120	5,837	46,696	8.00	64
1891	2	80	0	10,000	6,000	42,000	7.00	60
1892	3	84	30	12,372	7,177	50,446	7.03	58
1893	3	84	0	11,374	6,731	34,207	5.08	59
1894	3	84	0	8,563	5,245	18,249	3.48	61.2
1895	3	110	0	22,973	15,129	64,632	4.27	65.9
1896	3	120	0	38,685	25,949	104,894	4.04	67
1897	3	120	0	39,124	26,189	115,754	4.42	67
1898	2	90	0	48,559	30,197	128,933	4.27	62.2
1899	2	90	0	50,813	30,372	151,216	4.98	59.8
1900	2	90	0	54,310	33,387	160,165	4.797	61.5
1901	4	148	100	78,393	49,197	239,028	4.858	62.7

The character of the coal used in the manufacture of coke in Washington since 1890 is shown in the following table:

Character of coal used in the manufacture of coke in Washington since 1890.

[Short tons.]

Year.	Run of mine.		Slack.		Total.
	Unwashed.	Washed.	Unwashed.	Washed.	
1890	0	9,120	0	0	9,120
1891	0	0	10,000	0	10,000
1892	0	0	0	12,372	12,372
1893	0	10,974	0	405	11,379
1894	0	0	0	8,563	8,563
1895	0	0	0	22,973	22,973
1896	0	20,967	0	17,718	38,685
1897	0	39,124	0	0	39,124
1898	0	48,559	0	0	48,559
1899	0	44,681	0	6,132	50,813
1900	0	48,162	0	6,148	54,310
1901	0	69,272	0	9,121	78,393

WEST VIRGINIA.

West Virginia ranks second among the coke-producing States, although its total production in 1901 was only about 16 per cent of that of Pennsylvania. It is one of the five States in which the production last year was less than that of 1900, although the decrease was comparatively small. The total product in 1901 was 2,283,700 short tons, a decrease of 74,799 short tons, or 3.17 per cent, as compared with the output for the preceding year. The value declined $636,622. The decrease in production in 1901 was one of three instances in which the coke output of West Virginia in any year has been less than that of the preceding year. The statistics for 1901 show that there were 112 coke-making establishments in the State, with a total of 11,594 ovens, an increase of 6 establishments and 1,345 ovens in 1901. There were 1,204 new ovens in course of construction at the end of the year. Of the 112 establishments, 18, with a total of 752 ovens, were idle throughout the year. There were several other plants, particularly in the Monongahela district, that were idle from two to six months, such idleness being largely responsible for the decrease in production.

The following table exhibits the statistics of coke production in West Virginia since 1880:

Statistics of the manufacture of coke in West Virginia from 1880 to 1901, inclusive.

Year.	Establishments.	Ovens.		Coal used.	Coke produced.	Total value of coke at ovens.	Value of coke at ovens, per ton.	Yield of coal in coke.
		Built.	Building.					
				Short tons.	*Short tons.*			*Per cent.*
1880	18	631	40	230,758	138,755	$318,797	$2.30	60
1881	19	689	0	304,823	187,126	429,571	2.30	61
1882	22	878	0	366,653	230,398	520,437	2.26	63
1883	24	962	9	411,159	257,519	563,490	2.19	63
1884	27	1,005	127	385,588	223,472	425,952	1.91	62
1885	27	978	63	415,533	260,571	485,588	1.86	63
1886	29	1,100	317	425,002	264,158	513,843	1.94	62
1887	39	2,080	742	698,327	442,031	976,732	2.21	63.3
1888	51	2,764	318	854,531	525,927	896,797	1.71	61.5
1889	53	3,438	631	1,001,372	607,880	1,074,177	1.76	60
1890	55	4,060	334	1,395,266	833,377	1,524,746	1.83	60
1891	55	4,621	555	1,716,976	1,009,051	1,845,043	1.83	58.8
1892	72	5,843	978	1,709,183	1,034,750	1,821,965	1.76	60.5
1893	75	7,354	132	1,745,757	1,062,076	1,716,907	1.62	60.8
1894	78	7,858	60	1,976,128	1,193,933	1,639,687	1.373	60.4
1895	78	7,834	55	2,087,816	1,285,206	1,724,239	1.34	61.6
1896	84	8,351	28	2,687,104	1,649,755	2,259,999	1.37	61.4
1897	84	8,404	38	2,413,283	1,472,666	1,933,808	1.31	61
1898	87	[a] 8,659	161	3,145,398	1,925,071	2,432,657	1.26	61.2
1899	87	[a] 8,846	[b] 619	3,802,825	2,278,577	3,480,408	1.53	60
1900	106	[c] 10,249	1,306	3,868,840	2,358,499	4,746,633	2.01	60.9
1901	112	[c] 11,594	1,204	3,734,076	2,283,700	4,110,011	1.80	61.1

[a] Includes 60 Semet-Solvay ovens at Wheeling.

[b] Includes 60 Semet-Solvay ovens building at Wheeling.

[c] Includes 120 Semet-Solvay ovens at Wheeling.

As shown in the following table, by far the larger part (80 per cent in 1901) of the coal used in coke making in West Virginia is slack, and of this slack coal 90 per cent is unwashed:

Character of coal used in the manufacture of coke in West Virginia since 1890.

[Short tons.]

Year.	Run of mine.		Slack.		Total.
	Unwashed.	Washed.	Unwashed.	Washed.	
1890	324,847	0	930,989	139,430	1,395,266
1891	276,259	0	1,116,060	324,657	1,716,976
1892	298,824	115,397	1,108,353	186,609	1,709,183
1893	324,932	15,240	1,176,656	228,929	1,745,757
1894	162,270	14,901	1,607,735	191,222	1,976,128
1895	405,725	24,054	1,476,003	182,034	2,087,816
1896	407,378	33,096	2,079,237	167,393	2,687,104
1897	373,205	28,145	1,800,528	211,405	2,413,283
1898	713,815	0	2,137,983	293,600	3,145,398
1899	1,336,239	0	2,215,255	251,331	3,802,825
1900	509,960	8,000	3,140,064	210,816	3,868,840
1901	733,786	0	2,705,392	294,898	3,734,076

PRODUCTION BY DISTRICTS.

It has been customary in the preceding reports of this series to consider the coke production by districts, into which the State has been divided. These districts are known, respectively, as the Upper Monongahela, the Upper Potomac, the Kanawha, the New River, and the Flat Top. The first two are in the northern part of the State, and are named from the fact that they are drained by the headwaters of the Monongahela and Potomac rivers. The other three districts are in the southern portion of the State. The New River and Kanawha districts are practically one, separation being made at a point where the New and Gauley rivers combine to form the Kanawha. The Flat Top region is also drained by the upper portion of the New River, and includes the ovens in West Virginia which belong to the Pocahontas coal field. The Flat Top district is by far the most important, and bears the same relation to the production in West Virginia that the Connellsville district bears to that of Pennsylvania. The output from this district averages something over 50 per cent of the total coke product of the State.

The production fell off in every district in the State during 1901 with the exception of New River, which showed an increase of 57,846 tons over the preceding year. Prices declined in every district with the exception of the Upper Potomac, which is credited with a slight improvement.

In the following tables are exhibited the statistics of coke production in West Virginia, by districts, during the last two years:

Production of coke in West Virginia in 1900, by districts.

District.	Establishments.	Ovens.		Coal used.	Coke produced.	Total value of coke at ovens.	Value of coke at ovens, per ton.	Yield of coal in coke.
		Built.	Building.					
				Short tons.	*Short tons.*			*Per cent.*
Flat Top	[a] 38	5,290	666	1,952,274	1,208,838	$2,290,947	$1.895	61.9
Kanawha	11	847	80	291,277	165,339	412,636	2.495	56.7
New River	27	1,722	560	568,856	341,527	750,637	2.198	60
Upper Monongahela	24	[b] 1,563	0	584,265	355,861	817,340	2.297	60.9
Upper Potomac	6	827	0	472,168	286,934	475,073	1.655	60.8
Total	106	10,249	1,306	3,868,840	2,358,499	4,746,633	2.01	60.9

[a] Includes 1 establishment in Tug River district.

[b] Includes 120 Semet-Solvay ovens.

Production of coke in West Virginia in 1901, by districts.

District.	Establishments.	Ovens.		Coal used.	Coke produced.	Total value of coke at ovens.	Value of coke at ovens, per ton.	Yield of coal in coke.
		Built.	Building.					
				Short tons.	*Short tons.*			*Per cent.*
Flat Top	[a]42	6,049	918	1,899,366	1,160,856	$1,893,581	$1.63	61.1
Kanawha	11	927	0	281,787	164,736	314,473	1.909	58.4
New River	28	2,128	261	657,003	399,373	823,060	2.06	60.8
Upper Monongahela	25	[b]1,685	0	497,215	317,470	657,232	2.07	63.8
Upper Potomac	6	805	25	398,705	241,265	421,665	1.75	60.5
Total	112	11,594	1,204	3,734,076	2,283,700	4,110,011	1.80	61.1

[a] Includes 1 establishment in Tug River district.

[b] Includes 120 Semet-Solvay ovens.

Pocahontas–Flat Top district.—Next to the Connellsville district of Pennsylvania, this is the most important coke-producing district in the United States, and outside of Pennsylvania and Alabama produces more coke than any other single State. Like the Connellsville product, the coke of the Flat Top region makes an ideal fuel for blast-furnace purposes. It is chemically superior to the Connellsville, as it is lower in mineral contents, or ash, and is regarded by some iron masters as equal in physical properties to Connellsville coke. The production of the district in 1901 was 1,160,856 short tons, compared with 1,208,838 short tons in 1900.

The statistics of production of this district since its beginning, in 1886, are as follows:

Statistics of the manufacture of coke in the Flat Top district of West Virginia from 1886 to 1901, inclusive.

Year.	Establishments.	Ovens.		Coal used.	Coke produced.	Total value of coke at ovens.	Value of coke at ovens, per ton.	Yield of coal in coke.
		Built.	Building.					
				Short tons.	*Short tons.*			*Per cent.*
1886	2	10	38	1,075	658	$1,316	$2.00	61.2
1887	5	348	642	76,274	51,071	100,738	1.97	67
1888	13	882	200	164,818	103,947	183,938	1.77	63
1889	16	1,433	431	387,533	240,386	405,635	1.69	64
1890	17	1,584	252	566,118	325,576	571,239	1.75	57.5
1891	19	1,889	358	537,847	312,421	545,367	1.70	58
1892	30	2,848	933	595,734	353,696	596,911	1.69	59.3
1893	34	4,349	80	746,051	451,503	713,261	1.58	60.5
1894	36	4,648	18	1,229,136	746,762	989,876	1.325	60.7
1895	36	4,648	18	858,913	524,252	656,494	1.25	61
1896	36	4,648	18	1,400,369	852,120	1,100,312	1.291	60.8
1897	36	4,648	18	1,172,206	720,988	868,484	1.20	61.5
1898	36	4,667	27	1,701,404	1,057,626	1,216,059	1.15	62.2
1899	35	4,623	214	1,861,570	1,138,389	1,453,601	1.28	61.1
1900	[a]38	5,290	666	1,952,274	1,208,838	2,290,947	1.895	61.9
1901	[a]42	6,049	918	1,899,366	1,160,856	1,893,581	1.63	61.1

[a] Includes 1 establishment in the Tug River district.

Kanawha district.—The Kanawha district includes all the ovens along the banks of the Kanawha River, from its formation by the junction of the New and the Gauley rivers to the western limits of the coal fields. The production in 1901 was practically the same as that for 1900, amounting to 164,736 short tons.

The statistics of the manufacture of coke in the Kanawha district from 1880 to 1901 are as follows:

Statistics of the manufacture of coke in the Kanawha district, West Virginia, from 1880 to 1901, inclusive.

Year.	Establishments.	Ovens.		Coal used.	Coke produced.	Total value of coke at ovens.	Value of coke at ovens, per ton.	Yield of coal in coke.
		Built.	Building.					
				Short tons.	*Short tons.*			*Per cent.*
1880	4	18	0	6,789	4,300	$9,890	$2.30	63.3
1881	4	18	0	11,516	6,900	16,905	2.45	60
1882	5	138	0	40,782	26,170	62,808	2.40	64
1883	5	147	0	58,735	37,970	88,090	2.32	64.6
1884	6	177	15	60,281	39,000	76,070	1.95	64.6
1885	7	181	63	65,348	37,551	63,082	1.68	57
1886	7	302	170	89,410	54,329	117,649	2.17	60.7
1887	7	548	0	153,784	96,721	201,418	2.08	63
1888	9	572	8	141,641	84,052	146,837	1.75	59
1889	6	474	0	109,466	63,678	117,340	1.84	58
1890	6	474	0	182,340	104,076	196,583	1.89	57
1891	6	474	0	241,427	134,715	276,420	2.05	56
1892	6	506	0	242,627	140,641	284,174	2.02	58
1893	6	506	0	215,108	122,241	237,308	1.94	56.8
1894	6	506	0	176,746	104,160	181,586	1.74	58.9
1895	6	506	0	267,520	164,729	270,879	1.64	61.6
1896	7	576	10	259,715	157,741	263,210	1.67	60.7
1897	7	576	20	199,312	117,849	187,359	1.59	59.1
1898	8	622	100	225,240	135,867	208,949	1.538	60
1899	8	653	88	323,506	190,337	364,148	1.91	58.8
1900	11	847	80	291,277	165,339	412,636	2.495	56.7
1901	11	927	0	281,787	164,736	314,473	1.909	58.4

New River district.—This district includes the ovens along the Chesapeake and Ohio Railroad and New River from Quinnimont to Nuttallburg. The coal from which the coke is made is similar in many respects to that of the Flat Top region, and the coke product is highly prized as a blast-furnace fuel. This is the only district in the State in which the production in 1901 was larger than that of the preceding year. The product last year amounted to 399,373 tons, an increase of 57,846 tons over 1900, and was the largest output in the history of the district.

The statistics of the manufacture of coke in the New River district from 1880 to 1901 are as follows:

Statistics of the manufacture of coke in the New River district, West Virginia, from 1880 to 1901, inclusive.

Year.	Establishments.	Ovens.		Coal used.	Coke produced.	Total value of coke at ovens.	Value of coke at ovens, per ton.	Yield of coal in coke.
		Built.	Building.					
				Short tons.	*Short tons.*			*Per cent.*
1880	6	468	40	159,032	98,427	$239,977	$2.14	62
1881	6	499	0	219,446	136,423	334,652	2.45	62
1882	6	518	0	233,361	148,373	352,415	2.38	64
1883	6	546	0	264,171	167,795	384,552	2.29	64
1884	8	547	12	219,839	135,335	274,988	2.03	62
1885	8	519	0	244,769	156,007	325,001	2.08	63.8
1886	8	513	5	203,621	127,006	281,778	2.22	62
1887	11	518	50	253,373	159,836	401,164	2.51	63
1888	12	743	0	334,695	199,831	390,182	1.95	60
1889	12	773	0	268,185	157,186	351,132	2.23	58.6
1890	12	773	4	275,458	174,295	377,847	2.17	63
1891	13	787	102	309,073	193,711	426,630	2.20	63
1892	14	965	0	315,511	196,359	429,376	2.19	62
1893	13	947	10	281,600	178,049	355,965	2.00	65
1894	14	1,089	0	222,900	140,842	245,154	1.74	63.2
1895	14	978	0	385,899	244,815	404,978	1.65	63.4
1896	17	1,259	0	425,219	269,372	443,072	1.64	63.3
1897	17	1,225	0	439,103	268,263	419,151	1.56	61.1
1898	18	1,299	4	519,937	317,998	484,001	1.52	61
1899	22	1,444	167	503,160	281,134	533,996	1.90	56
1900	27	1,722	560	568,856	341,527	750,637	2.198	60
1901	28	2,128	261	657,003	399,373	823,060	2.06	60.8

Upper Monongahela district.—This district obtained its name from the fact that it is drained by the headwaters of the Monongahela River. The ovens lie along the Baltimore and Ohio Railroad, in the counties of Preston, Taylor, Harrison, and Marion. The district embraces the Clarksburg and Fairmont mining regions, which are among the most important of the State. One hundred and twenty Semet-Solvay ovens located at Wheeling have been included with this district. Nearly one-third of the total number of ovens of this district were idle throughout the entire year. The production of the district in 1901 amounted to 317,470 short tons, as against 355,861 short tons in 1900.

The statistics of coke production in the Upper Monongahela district since 1880 are shown in the following table:

Statistics of the manufacture of coke in the Upper Monongahela district, West Virginia, from 1880 to 1901, inclusive.

Year.	Establishments.	Ovens.		Coal used.	Coke produced.	Total value of coke at ovens.	Value of coke at ovens, per ton.	Yield of coal in coke.
		Built.	Building.					
				Short tons.	*Short tons.*			*Per cent.*
1880	8	145	0	64,937	36,028	$68,930	$1.91	55
1881	9	172	0	73,863	43,803	78,014	1.78	59
1882	11	222	0	92,510	55,855	105,214	1.88	60
1883	13	269	0	88,253	51,754	90,848	1.76	59
1884	13	281	100	78,468	49,139	74,894	1.52	63
1885	12	278	0	105,416	67,013	97,505	1.45	63.5
1886	12	275	104	131,896	82,165	113,100	1.38	62.3
1887	15	646	0	211,330	132,192	268,990	2.03	62.5
1888	17	567	110	213,377	138,097	175,840	1.27	64.7
1889	17	674	200	210,083	128,685	171,511	1.33	62.5
1890	18	1,051	50	276,367	167,459	260,574	1.56	60
1891	15	1,081	56	517,615	291,605	462,677	1.58	56
1892	19	1,129	45	441,266	265,363	390,296	1.47	60.1
1893	19	1,158	42	379,506	225,676	295,123	1.31	59
1894	20	1,221	42	280,748	158,623	179,525	1.13	56.5
1895	20	1,260	37	392,297	240,657	265,293	1.10	61.3
1896	22	1,386	0	331,526	206,429	211,272	1.023	62.3
1897	22	1,363	0	289,678	175,165	180,802	1.03	60.5
1898	23	[a] 1,449	30	319,590	183,430	194,277	1.06	57
1899	19	[a] 1,453	[b] 60	607,796	362,872	596,305	1.64	59.7
1900	24	[c] 1,563	0	584,265	355,861	817,340	2.297	60.9
1901	25	[c] 1,685	0	497,215	317,470	657,232	2.07	63.8

[a] Includes 60 Semet-Solvay ovens at Wheeling.
[b] All Semet-Solvay ovens at Wheeling.
[c] Includes 120 Semet-Solvay ovens at Wheeling.

Upper Potomac district.—The ovens located along the line of the West Virginia Central and Pittsburg Railway, which runs south from near Cumberland, Md., are in a region drained by the upper waters of the Potomac River, from which fact this district gets its name.

The production in 1901 was 241,265 short tons, as compared with 286,934 short tons in 1900 and 305,845 tons in 1899. Twenty-two ovens of this region were abandoned during the year, reducing the total number from 827 to 805.

The statistics of the manufacture of coke in the Upper Potomac district from 1887 to 1901 are shown in the following table:

Statistics of the manufacture of coke in the Upper Potomac district of West Virginia from 1887 to 1901, inclusive.

Year.	Establishments.	Ovens.		Coal used.	Coke produced.	Total value of coke at ovens.	Value of coke at ovens, per ton.	Yield of coal in coke.
		Built.	Building.					
				Short tons.	*Short tons.*			*Per cent.*
1887	1	20	50	3,565	2,211	$4,422	$2.00	62
1888	1	28	0	9,176	5,835	8,752	1.50	64
1889	2	84	0	26,105	17,945	28,559	1.58	69
1890	2	178	28	94,983	61,971	118,503	1.91	65
1891	2	390	39	111,014	76,599	133,549	1.75	69
1892	3	395	0	114,045	78,691	121,208	1.54	69
1893	3	394	0	123,492	84,607	115,250	1.36	68.5
1894	2	394	0	66,598	43,546	43,546	1.00	65.4
1895	2	442	0	183,187	110,753	126,595	1.14	60.5
1896	2	482	0	270,275	164,093	242,133	1.476	60.7
1897	2	592	0	312,984	190,401	278,012	1.46	60.8
1898	2	622	0	379,227	230,150	329,371	1.43	60.7
1899	3	673	90	506,793	305,845	532,358	1.74	60.3
1900	6	827	0	472,168	286,934	475,073	1.655	60.8
1901	6	805	25	398,705	241,265	421,665	1.75	60.5

OTHER STATES.

In the following table are presented the statistics of production in 1900 and 1901 of those States in which there are but one or two establishments.

Of the several States included in this statement, three of them—Michigan, New York, and Wisconsin—produced coke made from coal mined in other States, while one—Massachusetts—obtains its coal supply from Nova Scotia. All of the ovens in Massachusetts, New York, and Michigan are by-product retort ovens. The statistics of production for Illinois, Wisconsin, and Wyoming for previous years may be found by reference to preceding volumes of Mineral Resources.

Statistics of coke production in 1900 and 1901 in States having only one or two establishments.

Group of States.	Item.	1900.	1901.
Illinois Indiana Massachusetts Michigan New York Wisconsin Wyoming	Establishments	10	11
	Ovens built	[a] 832	[b] 862
	Ovens building	[c] 594	[d] 609
	Coke produced .... short tons	506,730	564,191
	Value of coke at ovens	$1,454,029	$1,607,476
	Value of coke at ovens .... per ton	$2.87	$2,849
	Coal used in manufacture of coke..short tons	708,295	793,187
	Value of coal used	$1,104,368	$1,288,558
	Value of coal .... per short ton	$1.559	$1.625
	Yield of coal in coke .... per cent	71.5	71.0

[a] Includes 30 Semet-Solvay and 400 Otto-Hoffman ovens.
[b] Includes 60 Semet-Solvay and 400 Otto-Hoffman ovens.
[c] Includes 30 Semet-Solvay and 564 Otto-Hoffman ovens.
[d] Includes 30 Semet-Solvay and 579 Otto-Hoffman ovens.

PETROLEUM.[a]

By F. H. Oliphant.

[The barrel used in this report, unless otherwise specified, is of 42 Winchester gallons.]

IMPORTANT FEATURES OF THE YEAR.

The most conspicuous features in the production and sale of petroleum in the United States during the year 1901 were as follows:

(1) The production of crude petroleum was greater than that of any previous year. (2) There was a very remarkable increase in the production of the States of Texas and California, a decrease in the production of the Appalachian or Eastern petroleum fields, and a slight gain in the output of the Lima-Indiana regions. (3) Of the total production in the United States, 80 per cent came from the older Appalachian and Lima-Indiana fields, leaving 20 per cent to be made up from all of the other fields; this amount is 11½ per cent greater than the proportion furnished in 1900. (4) There was an average decline of 24 cents per barrel of crude petroleum, or 20 per cent, at the wells in 1901, as compared with 1900. (5) There was a slight decrease in the number of wells completed in most of the important fields. (6) Stocks held in the Appalachian and the Lima-Indiana fields were slightly decreased. (7) The exports of petroleum and its products increased and were the largest ever recorded, although there was a slight decrease in their value. (8) The year was conspicuous for the new pools found and the new production in the Southern and Western States, followed by the organization of an immense number of petroleum stock companies, representing many millions of capital.

INCREASE IN PRODUCTION OF UNITED STATES.

The total production of crude petroleum in the United States in 1901 was 69,389,194 barrels, being larger than that of any previous year. It was larger by 5,768,665 barrels, or 9 per cent, than the production of the year 1900. The increase in the production of 1900 over 1899 was 6,291,854 barrels, or 11 per cent, and the increase in 1899 over 1898 was 3 per cent, or an average gain of 7.7 per cent for the last three years.

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[a] For much of the statistical information of the United States in this report credits should be given to the Oil City Derrick, and to Miss Belle Hill for the careful compilation of most of the tables. Other special acknowledgments are made in the body of the report.

The largest number of barrels marketed in the States outside of the Appalachian and Lima-Indiana fields was in California, although when the quantity produced but not sold is considered, the State of Texas takes precedence. The gain in new production from these two States alone was over 8,000,000 barrels; and when the increased yield in Kansas and Colorado is added, the percentage of the total petroleum produced outside of the older fields above named is changed from 8.6 per cent in 1900 to nearly 20 per cent in 1901. This is a difference of 11.4 per cent, and indicates that a rapid change is taking place in the localities from which an increased supply of petroleum is to be secured in the future.

The quality of the petroleum produced from these new sections is generally much inferior to that produced in the older fields, the quantity of first-class illuminating petroleum and other valuable derivatives being very much less. The greater part is valuable as a fuel in its natural state, or after some of the more volatile products have been removed, and is particularly acceptable as such in the absence of available deposits of coal in the Southwest and West.

PERCENTAGES OF PRODUCTION, BY FIELDS.

The following table shows the percentages of production in the Appalachian, Lima-Indiana, and all of the other fields combined for the years 1896 to 1901, inclusive:

Percentages of total crude petroleum produced in the several fields from 1896 to 1901, inclusive.

Field.	1896.	1897.	1898.	1899.	1900.	1901.
Appalachian	55.73	58.26	57.29	57.94	57.05	48.45
Lima-Indiana	41.43	37.71	36.70	35.44	34.20	31.61
All other	2.84	4.03	6.01	6.62	8.75	19.94
Total	100.00	100.00	100.00	100.00	100.00	100.00

An inspection of the above table reveals the fact that the past year shows a large falling off in the production of the Appalachian and the Lima-Indiana fields, especially the former. These fields furnish the petroleum from which the superior grades of illuminating oils are derived, which the newer fields in the Southwest and West so far as developed can only partially supply. It is this fact that keeps up the price of the petroleum in the older fields, especially in the old Appalachian field, which produces the purer grades of petroleum from which the greatest percentage of the best illuminants are obtained.

The new fields of California, Colorado, Kansas, Wyoming, and Texas produced practically 20 per cent of the total production in 1901, a gain of 11.4 per cent over 1900, with every indication that the Southwest and West will produce 35 per cent of the total output in 1902. The older fields will, however, decline slowly, judging from the gradual decline of the past; and the newer fields, with increased facilities for handling their product, must largely increase their production.

DECREASE IN PRICES AND VALUE.

The average price paid for all of the petroleum marketed in the United States during 1901 was 95.7 cents per barrel, as compared with $1.194 in 1900, showing a decrease of 23.7 cents per barrel, which is the lowest price since 1898.

The gross decrease in value for 1901, as compared with 1900, was nearly 13 per cent, notwithstanding the quantity increased for the same period slightly over 9 per cent.

The average price paid for what is known as Pennsylvania petroleum, which represents 48.5 per cent of the total production, was $1.21 per barrel in 1901, as compared with 57 per cent produced in 1900 and marketed at an average price of $1.356 per barrel, a decline of 14.6 cents per barrel, or 11 per cent.

There was a decline of 37.7 cents per barrel in the average price paid for California petroleum and a decline of 76 cents per barrel for the Texas product in 1901 as compared with 1900, which is accounted for by the increased production of the new fields developed in both of these States.

DECREASE IN NUMBER OF WELLS DRILLED.

The total number of wells drilled in 1901 in the Appalachian and the Lima-Indiana fields was 12,705. Of this number 2,773 were dry or failed to produce petroleum in paying quantities, leaving 9,932 productive wells, which represents 78 per cent of the total number drilled. The total number of wells drilled in 1900 was 14,583; in 1901 it was 12,705, a decrease of 1,878 wells, or over 12 per cent. The total number of wells completed in 1901 in the entire United States in the search for petroleum approximates 14,250. Of this number 3,220 are estimated to be dry, leaving 11,030 that were productive. If the 14,250 wells cost, on an average, $1,500 each, they represent an outlay of $21,375,000, approximately one-third of the receipts for the entire crude product.

INCREASE IN EXPORTS.

In 1901, for the first time in the history of the trade, the total number of gallons of petroleum and its derivatives exported exceeded one billion. The exact number of gallons was 1,062,750,306, an increase of 87,626,830 gallons over the exports of 1900, a gain of 9 per cent.

The total value of the amount exported in 1901 was $71,479,124. The total value of the amount exported in 1900 was $73,276,282, 1900 being the only year that was greater than 1901.

The export of all the manufactured products increased during 1901; that is, illuminating and lubricating oils, paraffins, naphtha, and the residuum, but the quantity of crude petroleum exported decreased about 13,000,000 gallons as compared with 1900.

The total number of gallons of manufactured petroleum exported by Russia in 1901 was 390,920,095, about 36.8 per cent of the quantity exported by the United States. Of this amount, 72,856,645 gallons were exported to the United Kingdom, as compared with 206,198,737 gallons exported to the United Kingdom from the United States, a large proportion of which goes to England and is there consumed.

The price received by the exporters of illuminating products from the United States is from three-fourths of a cent to 1 cent per gallon higher than the price received for the Russian products, and is sufficient proof of their superior quality.

The average price received for all the various grades of petroleum exported in 1901 was 6.73 cents per gallon, as compared with 7.52 cents per gallon received in 1900 and with 6.83 cents per gallon in 1899.

NEW POOLS DISCOVERED AND COMPANIES ORGANIZED.

On January 10, 1901, the immense gusher was developed at Beaumont, Tex., which caused an unprecedented investment of capital, representing a great number of newly organized stock companies. California was also the scene of many organizations of stock companies, especially in the section surrounding Bakersfield, embracing the Kern, McKitrick, and Sunset pools.

The development at Boulder, Colo., had just begun at the close of 1901, and early in 1902 a large number of stock companies were organized at Boulder and other points in Colorado and in Wyoming.

The following table gives a careful estimate of the number of companies organized in 1901, and their capitalization, together with the companies organized that have not named their capital; also the number of companies that have produced petroleum during 1901. This serves to illustrate the activity during the year.

Of the 1,478 companies organized, representing $663,283,000 in stock, 556 produced more or less petroleum. A large majority of those which had no production have very little value to represent their capital; many exist on paper alone. The result must be disappointment and loss to the great number of investors who have been beguiled into the purchase of stock by the professional promoter.

Number of companies organized, with capitalization given; companies organized, with no capitalization given, together with the number of companies producing petroleum, by States and Territories, for the year 1901.

State or Territory.	Companies capitalized in 1901.		Additional companies capitalized in 1901, no capitalization given.	Companies which produced crude petroleum in 1901.
	Number.	Capitalization.		
Alabama	25	$8,100,000	....	....
Arizona	90	73,225,000	3	....
Arkansas	14	3,128,000	1	....
California	377	138,207,000	....	400
Colorado	19	2,370,000	10	8
Florida	3	2,150,000	4	....
Georgia	3	1,060,000	....	....
Idaho	1	100,000	4	....
Illinois	....	....	....	1
Indian Territory	2	3,100,000	....	1
Kansas	3	1,800,000	....	3
Kentucky	64	26,808,000	12	11
Louisiana	76	41,063,000	....	....
Maryland	4	1,150,000	....	....
Michigan	1	150,000	1	1
Mississippi	9	1,685,000	....	....
Missouri	17	4,721,000	5	1
Montana	1	100,000	....	....
New Mexico	1	1,000,000	8	....
Oklahoma Territory	11	5,960,000	1	1
Oregon	3	1,112,500	6	....
South Dakota	19	17,658,000	....	....
Tennessee	22	6,038,000	5	1
Texas	619	283,509,500	....	122
Utah	40	6,756,500	....	....
Virginia	7	360,000	....	....
Washington	4	1,300,000	22	....
West Virginia	30	24,421,500	4	5
Wyoming	13	3,250,000	14	1
Total	1,478	663,283,000	100	556

The 100 companies organized with no capitalization given have an estimated stock capital of $5,800,000. This gives a total of 1,578 companies, with a total stock capital of $669,083,000.

PRODUCTION AND VALUE.

PRODUCTION BY STATES AND FIELDS.

In the following table is given a statement of the total amount and the total value of all crude petroleum produced in the United States in 1900 and 1901, by States and important districts:

Total amount and value of crude petroleum produced in the United States, and average price per barrel in 1900 and 1901.

State and district.	1900.			1901.		
	Quantity.	Value.	Average value per barrel.	Quantity.	Value.	Average value per barrel.
	Barrels.			*Barrels.*		
California	4,324,484	$4,076,975	$0.943	8,786,330	$4,974,540	$0.566
Colorado	317,385	323,434	1.019	460,520	461,031	1.00
Illinois	200	1,000	5.00	250	1,250	5.00
Indiana	4,874,392	4,693,983	.963	5,757,086	4,822,826	.8377
Kansas	74,714	69,142	.925	179,151	154,373	.862
Kentucky and Tennessee	[a]62,259	46,782	.75	137,259	111,527	.813
Indian Territory Michigan Missouri Oklahoma Territory	8,074	6,031	.747	12,335	9,725	.788
New York	1,300,925	1,759,501	1.35¼	1,206,618	1,460,008	1.21
Ohio:						
Eastern and southern	5,476,089	7,406,734	1.35¼	5,470,850	6,619,342	1.21
Lima	16,884,358	16,673,304	.98¾	16,176,293	13,911,612	.86
Mecca-Belden	2,283	11,563	5.06½	940	2,617	2.78
Total	22,362,730	24,091,601	1.077	21,648,083	20,533,571	.948
Pennsylvania:						
Franklin	59,036	236,144	4.00	55,162	220,648	4.00
Pennsylvania	13,197,866	17,850,114	1.35¼	12,568,806	15,208,255	1.21
Smiths Ferry	1,300	1,758	1.35¼	1,410	1,706	1.21
Total	13,258,202	18,088,016	1.364	12,625,378	15,430,609	1.222
Texas	836,039	871,996	1.043	4,393,658	1,247,351	.284
West Virginia:						
Burning Springs West Virginia	16,176,757	21,879,064	1.35¼	14,164,662	17,139,241	1.21
Petroleum [b] Volcano [c]	18,918	43,638	2.307	12,464	33,483	2.687
Total	16,195,675	21,922,702	1.353	14,177,126	17,172,724	1.211
Wyoming	5,450	38,150	7.00	5,400	37,800	7.00
Grand total	63,620,529	75,989,313	1.194	69,389,194	66,417,335	.957+

[a] Includes 41,405 barrels sold in 1900, but produced in previous years.
[b] Production of light oil in Petroleum included with West Virginia's product.
[c] Production of light oil in Volcano included with West Virginia's product.

The increase or decrease in the production by States, as well as the percentages of increase or decrease in 1901 compared with 1900, is shown in the following table:

Total production of crude petroleum and percentage of increase or decrease, by States, in 1901 as compared with 1900.

States.	Production.		Increase.	Decrease.	Percentage.	
	1900.	1901.			Increase.	Decrease.
	Barrels.	*Barrels.*	*Barrels.*	*Barrels.*	*Per cent.*	*Per cent.*
California	4,324,484	8,786,330	4,461,846	....	103.18	....
Colorado	317,385	460,520	143,135	....	45.09	....
Illinois	200	250	50	....	25.00	....
Indiana	4,874,392	5,757,086	882,694	....	18.11	....
Kansas	74,714	179,151	104,437	....	139.78	....
Kentucky and Tennessee	62,259	137,259	75,000	....	120.46	....
Indian Territory Michigan Missouri Oklahoma Territory	8,074	12,335	4,261	....	52.77	....
New York	1,300,925	1,206,618	....	94,307	....	7.25
Ohio	22,362,730	21,648,083	....	714,647	....	3.19
Pennsylvania	13,258,202	12,625,378	....	632,824	....	4.77
Texas	836,039	4,393,658	3,557,619	....	425.53	....
West Virginia	16,195,675	14,177,126	....	2,018,549	....	12.46
Wyoming	5,450	5,400	....	50	....	.92
Total	63,620,529	69,389,194	5,768,665	....	9.067	....

The most conspicuous increase is that of Texas. Although the increase in the number of barrels is not so great as for California, the proportion of the increase is greater. Kansas shows a large proportionate increase, as does Kentucky. The decrease in West Virginia is marked, because this State in 1900 showed a gain of 16.43 per cent, but in 1901 there is a decrease of 12.46 per cent.

The production of petroleum in the principal fields of the United States from 1896 to 1901, inclusive, was as follows:

Production of petroleum in the United States from 1896 to 1901, inclusive, by fields.

[Barrels of 42 gallons.]

Field.	1896.	1897.	1898.	1899.	1900.	1901.
Appalachian	33,971,902	35,230,271	31,717,425	33,068,356	36,295,433	33,618,171
Lima-Indiana	25,255,870	22,805,033	20,321,323	20,225,356	21,758,750	21,933,379
Southern California	1,252,777	1,903,411	2,257,207	2,642,095	4,324,484	8,786,330
Florence, Colorado	361,450	384,934	444,383	390,278	317,385	460,520
Kansas	113,571	81,098	71,980	69,700	74,714	179,151
Texas	1,450	65,975	546,070	669,013	836,039	4,393,658
Wyoming	2,878	3,650	5,475	5,560	5,450	5,400
Other	463	1,144	370	492	8,274	12,585
Total	[a] 60,960,361	[a] 60,475,516	[a] 55,364,233	[a] 57,070,850	[b] 63,620,529	69,389,194

[a] In addition to this amount, 4,325 barrels of crude oil were produced in Kentucky and Tennessee in 1896, 4,377 barrels in 1897, 19,125 barrels in 1898, and 13,578 barrels in 1899, for which, as none was sold or used, no value could be given.

[b] Includes 41,405 barrels of oil sold in Kentucky and Tennessee in 1900, but produced in previous years.

The remarkable regularity in the production of the Appalachian and the Lima-Indiana fields for the last six years is exhibited in the above table. Were it not for the large increase in California and Texas the total production for the six years ending December 31, 1901, would show only comparatively slight variations.

PRODUCTION OF CRUDE PETROLEUM IN UNITED STATES, 1859 TO 1901, INCLUSIVE.

In the following table will be found a statement of the production of crude petroleum in the United States from the beginning of production, marked by the drilling of the Colonel Drake well in 1859, up to and including the production of 1901, the table being by years and States:

Production of crude petroleum in the United States from 1859 to 1901, inclusive.

[Barrels of 42 gallons.]

Year.	Pennsylvania and New York.	Ohio.	West Virginia.	California.	Kentucky and Tennessee.	Colorado.	Indiana.
1859	2,000	....	....	....	....	....	....
1860	500,000	....	....	....	....	....	....
1861	2,113,609	....	....	....	....	....	....
1862	3,056,690	....	....	....	....	....	....
1863	2,611,309	....	....	....	....	....	....
1864	2,116,109	....	....	....	....	....	....
1865	2,497,700	....	....	....	....	....	....
1866	3,597,700	....	....	....	....	....	....
1867	3,347,300	....	....	....	....	....	....
1868	3,646,117	....	....	....	....	....	....
1869	4,215,000	....	....	....	....	....	....
1870	5,260,745	....	....	....	....	....	....
1871	5,205,234	....	....	....	....	....	....
1872	6,293,194	....	....	....	....	....	....
1873	9,893,786	....	....	....	....	....	....
1874	10,926,945	....	....	....	....	....	....
1875	8,787,514	[a]200,000	[a]3,000,000	[a]175,000	....	....	....
1876	8,968,906	31,763	120,000	12,000	....	....	....
1877	13,135,475	29,888	172,000	13,000	....	....	....
1878	15,163,462	38,179	180,000	15,227	....	....	....
1879	19,685,176	29,112	180,000	19,858	....	....	....
1880	26,027,631	38,940	179,000	40,552	....	....	....
1881	27,376,509	33,867	151,000	99,862	....	....	....
1882	30,053,500	39,761	128,000	128,636	[b]160,933	....	....
1883	23,128,389	47,632	126,000	142,857	4,755	....	....
1884	23,772,209	90,081	90,000	262,000	4,148	....	....
1885	20,776,041	661,580	91,000	325,000	5,164	....	....
1886	25,798,000	1,782,970	102,000	377,145	4,726	....	....
1887	22,356,193	5,022,632	145,000	678,572	4,791	76,295	....
1888	16,488,668	10,010,868	119,448	690,333	5,096	297,612	....
1889	21,487,435	12,471,466	544,113	303,220	5,400	316,476	33,375
1890	28,458,208	16,124,656	492,578	307,360	6,000	368,842	63,496
1891	33,009,236	17,740,301	2,406,218	323,600	9,000	665,482	136,634

[a] Includes all production prior to 1876.
[b] Includes all petroleum produced in Kentucky and Tennessee prior to 1883.

Production of crude petroleum in the United States from 1859 to 1901, inclusive—Cont'd.

[Barrels of 42 gallons.]

Year.	Pennsylvania and New York.	Ohio.	West Virginia.	California.	Kentucky and Tennessee.	Colorado.	Indiana.
1892	28,422,377	16,362,921	3,810,086	385,049	6,500	824,000	698,068
1893	20,314,513	16,249,769	8,445,412	470,179	3,000	594,390	2,335,293
1894	19,019,990	16,792,154	8,577,624	705,969	1,500	515,746	3,688,666
1895	19,144,390	19,545,233	8,120,125	1,208,482	1,500	438,232	4,386,132
1896	20,584,421	23,941,169	10,019,770	1,252,777	1,680	361,450	4,680,732
1897	19,262,066	21,560,515	13,090,045	1,903,411	322	384,934	4,122,356
1898	15,948,464	18,738,708	13,615,101	2,257,207	5,568	441,383	3,730,907
1899	14,374,512	21,142,108	13,910,630	2,642,095	18,280	390,278	3,848,182
1900	14,559,127	22,362,730	16,195,675	4,324,484	62,259	317,385	4,874,392
1901	13,831,996	21,648,083	14,177,126	8,786,330	137,259	460,520	5,757,086
Total	615,217,846	262,737,086	118,187,951	27,850,205	447,881	6,456,025	38,355,319

Year.	Illinois.	Kansas.	Texas.	Missouri.	Indian Territory.	Wyoming.	United States.
1859	....	....	....	....	....	....	2,000
1860	....	....	....	....	....	....	500,000
1861	....	....	....	....	....	....	2,113,609
1862	....	....	....	....	....	....	[a]3,056,690
1863	....	....	....	....	....	....	2,611,309
1864	....	....	....	....	....	....	2,116,109
1865	....	....	....	....	....	....	2,497,700
1866	....	....	....	....	....	....	3,597,700
1867	....	....	....	....	....	....	3,347,300
1868	....	....	....	....	....	....	3,646,117
1869	....	....	....	....	....	....	4,215,000
1870	....	....	....	....	....	....	5,260,745
1871	....	....	....	....	....	....	5,205,234
1872	....	....	....	....	....	....	6,293,194
1873	....	....	....	....	....	....	9,893,786
1874	....	....	....	....	....	....	10,926,945
1875	....	....	....	....	....	....	[b]12,162,514
1876	....	....	....	....	....	....	9,132,669
1877	....	....	....	....	....	....	13,350,363
1878	....	....	....	....	....	....	15,396,868
1879	....	....	....	....	....	....	19,914,146
1880	....	....	....	....	....	....	26,286,123
1881	....	....	....	....	....	....	27,661,238
1882	....	....	....	....	....	....	30,510,830
1883	....	....	....	....	....	....	23,449,633
1884	....	....	....	....	....	....	24,218,438
1885	....	....	....	....	....	....	21,858,785
1886	....	....	....	....	....	....	28,064,841
1887	....	....	....	....	....	....	28,283,483
1888	....	....	....	....	....	....	27,612,025
1889	1,460	500	48	20	....	....	35,163,513
1890	900	1,200	54	278	....	....	45,823,572
1891	675	1,400	54	25	30	....	54,292,655
1892	521	....	45	10	80	....	50,509,657
1893	400	18,000	50	50	10	....	48,431,066

[a] In addition to this amount, it is estimated that for want of a market some 10,000,000 barrels ran to waste in and prior to 1862 from the Pennsylvania fields; also a large amount from West Virginia and Tennessee.

[b] Includes all production prior to 1876 in Ohio, West Virginia, and California.

Production of crude petroleum in the United States from 1859 to 1901, inclusive—Cont'd.

[Barrels of 42 gallons.]

Year.	Illinois.	Kansas.	Texas.	Missouri.	Indian Territory.	Wyoming.	United States.
1894	300	40,000	60	8	130	2,369	49,344,516
1895	200	44,430	50	10	37	3,455	52,892,276
1896	250	113,571	1,450	43	170	2,878	[a]60,960,361
1897	500	81,098	65,975	19	625	3,650	[a]60,475,516
1898	360	71,980	546,070	10	....	5,475	[a]55,364,233
1899	360	69,700	669,013	[b]132	....	5,560	[a]57,070,850
1900	200	74,714	836,039	[c]8,074	....	5,450	63,620,529
1901	250	179,151	4,393,658	[d]12,335	....	5,400	69,389,194
Total	6,376	695,744	6,512,566	21,014	1,082	34,237	1,076,523,332

[a] In addition to this amount, 4,325 barrels of crude oil were produced in Kentucky and Tennessee in 1896, 4,377 barrels in 1897, 19,125 barrels in 1898, and 13,578 barrels in 1899, for which, as none was sold or used, no value could be given.

[b] Includes the production of Michigan.

[c] Includes production of Michigan and Indian Territory.

[d] Includes production of Michigan and Indian Territory and small production in Oklahoma Territory.

The total output of crude petroleum since the first discovery, in 1859, by Colonel Drake, on Oil Creek, near Titusville, Pa., to the close of 1901, amounted to 1,076,523,332 barrels. If 5.6 cubic feet represent the cubical contents of a barrel, this quantity of petroleum would occupy 6,028,530,659 cubic feet of space, which space would represent a cube very close to 1,820 feet on its sides. This amount of petroleum would fill a tank whose base is 1 square mile to a height of 216.3 feet. It would likewise fill 35,884 tanks containing 30,000 barrels each. Allowing 90 feet for the diameter of these tanks, and if they were placed so that their sides would touch and were extended in a straight line, they would reach a distance of 611.7 miles; or, again, if we allow 2½ feet for the height of a barrel, and if these barrels were laid so that their heads would touch, they would encircle the earth 21.2 times.

Of the grand total of the petroleum produced in the United States from 1859 to the end of 1901 Pennsylvania produced 53 per cent; Ohio, 24 per cent; West Virginia, 11 per cent; New York, 4 per cent; Indiana, 3.6 per cent; California, 2.6 per cent; leaving 1.8 per cent to be furnished by the other producing States.

DECREASE IN APPALACHIAN FIELD.

This field embraces all the districts producing what is popularly known as "Pennsylvania oil." It extends from Wellsville, in New York State, on the northeast, down through western Pennsylvania into West Virginia, and includes a large portion of southeastern Ohio. Its extension through Kentucky and Tennessee into northern Alabama has not been attended with any noteworthy developments. The production in Tennessee has been very small, and Alabama has produced no oil in marketable quantities.

There was a decrease of 2,677,262 barrels, or 7.376 per cent, in this field in 1901 compared with 1900. The greatest decrease was in West Virginia, amounting to 12.46 per cent compared with the product of 1900.

There was an increase of 9.63 per cent in 1900 over 1899 in this field as a whole. The West Virginia increase was 16.43 per cent for the same year. The absence of any large new pools except in Ohio accounts for the deficiency in 1901. New territory always produces largely when first developed, and after the first year it usually approaches more closely to the general average. The new pools found in southeastern Ohio sustained the production in that State so that the production for 1901 and 1900 were practically equal.

The following table gives the production of the Appalachian States in 1900 and 1901, with the percentage of their increase or decrease. A part of the production in Ohio comes from another field, known as the Lima-Indiana field, but is not included in this table.

Production of petroleum in the Appalachian field in 1900 and 1901, by States, showing increase or decrease.

State.	Production.		Increase.	Decrease.	Percentage.	
	1900.	1901.			Increase.	Decrease.
	Barrels.	*Barrels.*	*Barrels.*	*Barrels.*	*Per cent.*	*Per cent.*
New York	1,300,925	1,206,618		94,307		7.25
Pennsylvania	13,258,202	12,625,378		632,824		4.77
West Virginia	16,195,675	14,177,126		2,018,549		12.46
Southeastern Ohio	5,478,372	5,471,790		6,582		.12
Kentucky and Tennessee	62,259	137,259	75,000		120.46	
Total	36,295,433	33,618,171		2,677,262		7.376

INCREASE IN LIMA-INDIANA FIELD.

This field embraces a portion of northwestern Ohio and central Indiana. The petroleum in this field comes from the Trenton limestone and carries a small percentage of sulphur. The petroleum from the Appalachian field is found almost entirely in sandstone, and is generally known as "white-sand oil." It is free from sulphur, produces a larger percentage of illuminating oil, and is more easily refined. There was produced in the Lima-Indiana field in 1901 a total of 21,933,379 barrels, showing a gain of 0.8 per cent as compared with 7.5 per cent in 1900 over that of 1899. This falling off in the production is due to the deficiency in Ohio, while Indiana showed a decided gain.

Production of petroleum in the Lima-Indiana field in 1900 and 1901.

State.	Production.		Increase.	Decrease.	Percentage.	
	1900.	1901.			Increase.	Decrease.
	Barrels.	*Barrels.*				
Ohio	16,884,358	16,176,293	....	708,065	....	4.2
Indiana	4,874,392	5,757,086	882,694	....	18.1	....
Total	21,758,750	21,933,379	174,629	....	.80	....

WELLS AND STOCKS IN APPALACHIAN AND LIMA-INDIANA FIELDS.

In the following tables are shown the number of wells completed and dry holes in the Appalachian and Lima-Indiana fields for the years 1900 and 1901:

Number of wells completed and dry holes in the Appalachian and Lima-Indiana fields in 1900 and 1901.

Month.	Appalachian.		Lima-Indiana.		Total both fields.	
	Completed.	Dry.	Completed.	Dry.	Completed.	Dry.
1900.						
January	633	140	412	42	1,045	182
February	591	123	327	22	918	145
March	599	153	389	46	988	199
April	797	183	553	62	1,350	245
May	859	220	630	85	1,489	305
June	877	233	599	71	1,476	304
July	814	209	565	77	1,379	286
August	807	191	495	60	1,302	251
September	796	185	491	37	1,287	222
October	766	182	495	60	1,261	242
November	672	166	414	59	1,086	225
December	634	175	368	41	1,002	216
Total	8,845	2,160	5,738	662	14,583	2,822
1901.						
January	589	167	340	35	929	202
February	506	160	268	23	774	183
March	479	134	261	45	740	179
April	589	172	381	47	970	219
May	673	167	451	59	1,124	226
June	692	186	453	61	1,145	247
July	655	183	421	46	1,076	229
August	727	200	416	51	1,143	251
September	729	214	479	53	1,208	267
October	712	175	514	63	1,226	238
November	766	215	541	61	1,307	276
December	592	145	386	46	978	191
Total	7,709	2,118	4,911	590	12,620	2,708

The number of productive wells completed is the difference between the completed wells and the dry holes in the above.

The proportion of the dry holes drilled in 1901 to the total number completed was 21.5 per cent as compared with 19.4 per cent in 1900.

Stocks of petroleum held by pipe lines at close of 1899, 1900, and 1901 in the Appalachian and Lima-Indiana fields.

[Barrels of 42 gallons.]

	1899.	1900.	1901.
National Transit Co	7,615,626	8,174,506	5,069,782
Southwest Pennsylvania Pipe Line Co	1,560,443	1,368,892	865,477
Eureka Pipe Line Co	1,593,080	1,401,201	1,465,606
Buckeye Pipe Line Co (Macksburg oil)	674,583	591,899	476,491
Cumberland Pipe Line Co	....	....	128,574
Southern Pipe Line Co	396,256	471,599	391,892
Crescent Pipe Line Co	73,633	103,808	126,052
New York Transit Co	756,120	533,030	330,666
Tidewater Pipe Co	294,265	334,308	345,643
Producers and Refiners' Oil Co	140,966	148,769	139,868
Elk Oil Co	597	595	628
Emery Pipe Line Co	25,102	20,252	22,470
United States Pipe Line Co	33,148	25,857	57,271
Other lines	287,372	300,832	215,072
Total stocks Appalachian field	13,451,191	13,475,548	9,635,492
Total Lima-Indiana stocks	10,545,927	14,988,928	17,760,306
Total both fields	23,997,118	28,464,476	27,395,798

EXPORTS.

The following tables are the official statement of the amount and value of petroleum and its products (mineral oils) exported from the United States for the year ending December 31, 1901, as compared with the preceding year:

Exports of mineral oils from the United States in 1900 and 1901.

Port and kind.	1900.		1901.	
CRUDE.	*Gallons.*		*Gallons.*	
Delaware	101,047,806	$5,283,622	93,061,901	$4,434,836
New York	3,423,169	250,950	2,559,109	184,444
Philadelphia	33,030,185	1,775,698	29,027,920	1,395,854
Total	137,501,160	7,310,270	124,648,930	6,015,134
NAPHTHA.				
Baltimore	4,323	404	....	....
Boston and Charlestown	3,910	765	1,752	346
Delaware	1,054,452	68,539	1,290	168
New York	11,223,617	1,177,555	11,724,631	1,140,450
Philadelphia	5,976,442	400,806	8,986,200	504,019
Total	18,262,744	1,648,069	20,713,873	1,644,983

Exports of mineral oils from the United States in 1900 and 1901—Continued.

Port and kind.	1900.		1901.	
ILLUMINATING.	*Gallons.*		*Gallons.*	
Baltimore	42,645,471	$2,997,744	39,479,316	$2,774,106
Boston and Charlestown	729,546	75,584	495,900	49,053
Delaware	2,316,085	174,143	1,500	133
New York	509,291,233	38,835,002	526,294,414	35,236,879
Philadelphia	175,603,152	11,851,083	251,104,714	14,655,485
Total	730,585,487	53,933,556	817,375,844	52,715,656
LUBRICATING AND PARAFFIN.				
Baltimore	1,366,583	175,031	711,817	95,993
Boston and Charlestown	184,161	33,934	146,317	25,295
New York	54,760,098	7,926,783	53,082,986	7,786,256
Philadelphia	12,686,873	1,406,870	19,090,007	1,970,680
Total	68,997,715	9,542,618	73,031,127	9,878,224
RESIDUUM.				
Boston and Charlestown	43,890	2,900	36,440	1,830
New York	10,228,008	423,722	10,444,350	500,779
Philadelphia	9,504,472	415,147	16,499,742	722,518
Total	19,776,370	841,769	26,980,532	1,225,127
Grand total	975,123,476	73,276,282	1,062,750,306	71,479,124

RECAPITULATION BY KINDS.

Crude petroleum	137,501,160	$7,310,270	124,648,930	$6,015,134
Naphtha	18,262,744	1,648,069	20,713,873	1,644,983
Illuminating oil	730,585,487	53,933,556	817,375,844	52,715,656
Lubricating oil and paraffin	68,997,715	9,542,618	73,031,127	9,878,224
Residuum	19,776,370	841,769	26,980,532	1,225,127
Total	975,123,476	73,276,282	1,062,750,306	71,479,124

RECAPITULATION BY PORTS.

Baltimore	44,016,377	$3,173,179	40,191,133	$2,870,099
Boston and Charlestown	961,507	113,183	680,409	76,524
Delaware	104,418,343	5,526,304	93,064,691	4,435,137
New York	588,926,125	48,614,012	604,105,490	44,848,808
Philadelphia	236,801,124	15,849,604	324,708,583	19,248,556
Grand total	975,123,476	73,276,282	1,062,750,306	71,479,124

New York continued to be the leading port for the export of petroleum and its products during 1901. Of the total amount shipped abroad about 56.84 per cent was loaded at that city; at Philadelphia, 30.55 per cent; in Delaware ports, 8.76 per cent; at Baltimore, 3.78 per cent; at Boston and Charlestown less than one-tenth of 1 per cent. It is estimated that 45 per cent of the entire product of the crude petroleum produced in the United States finds a market abroad.

A table given elsewhere shows the high duties that are imposed by almost all countries excepting Great Britain, and indicates that no other artificial source of light can replace petroleum in the markets of the world, even where the highest duties are levied.

Exports of mineral oils from the United States from 1887 to 1901, inclusive.

[Gallons.]

Year.	Crude.	Naphtha.	Illuminating.	Lubricating and paraffin.	Residuum.	Total.	
						Quantity.	Value.
1887	80,643,839	12,344,669	464,702,903	20,340,820	2,989,098	581,021,329	$45,231,988
1888	77,387,799	13,466,234	450,801,683	24,280,826	1,861,104	567,797,646	47,563,749
1889	84,144,196	13,958,985	548,496,241	27,754,239	1,837,794	676,191,455	52,792,473
1890	95,368,525	12,406,586	547,542,569	31,896,146	1,828,900	689,042,726	51,657,302
1891	94,926,424	11,398,085	526,972,018	33,068,716	932,692	667,297,935	45,351,957
1892	104,012,829	16,351,340	586,406,366	33,805,128	329,574	740,905,237	42,283,163
1893	114,609,343	16,249,389	705,674,917	34,762,754	460,614	871,757,017	41,117,814
1894	114,268,611	14,831,967	726,726,687	38,975,128	59,766	894,862,159	40,463,088
1895	115,954,128	12,757,940	677,500,647	46,769,565	143,850	853,126,130	56,223,425
1896	117,921,276	13,420,769	749,305,844	50,629,143	507,990	931,785,022	62,764,278
1897	121,488,726	13,430,320	795,919,525	51,228,284	12,230,902	994,297,757	59,057,547
1898	114,915,082	17,026,626	761,152,107	63,968,341	29,418,454	986,480,610	52,551,048
1899	117,683,967	17,904,015	724,562,993	69,329,188	21,544,278	951,024,441	64,982,249
1900	137,501,160	18,262,744	730,585,487	68,997,715	19,776,370	975,123,476	73,276,282
1901	124,648,930	20,713,873	817,375,844	73,031,127	26,980,532	1,062,750,306	71,479,124

This table illustrates the fact that for many years prior to 1901 the quantity of illuminating petroleum exported was remarkably steady. The figures for 1901 show a sudden increase, amounting to 12 per cent, and is the largest export up to this time. The illuminating variety amounted to 77 per cent of the total exportation of mineral oils. All of the other varieties increased in the amount exported, excepting crude petroleum, which decreased. It will be noticed that the value of all our mineral oils exported in 1901 was about 2.50 per cent less than in 1900, yet there was an increase of 9 per cent in the total production of crude petroleum in 1901 over 1900. This increase, however, came from the fields of the West and Southwest, whose general output can not be converted into marketable products.

Exports of mineral oil from the United States in years 1898–1901, by months.

Month.	1898.		1899.	
	Gallons.		*Gallons.*	
January	85,412,917	$3,989,811	62,385,776	$3,817,129
February	62,091,132	2,998,714	51,759,280	3,403,331
March	85,944,541	4,243,945	85.273,703	5,291,534
April	76,649,229	3,929,149	66,873,657	4,267,075
May	86,431,145	4,571,862	87,216,379	5,210,928
June	93,109,931	4,972,286	87,214,749	5,481,991
July	89,982,205	4,722,093	81,171,542	5,245,519
August	97,457,340	5,010,507	100,220,318	6,565,691
September	87,999,604	4,779,026	92,676,402	7,007,626
October	79,524,827	4,643,148	86,562,810	6,583,145
November	76,007,690	4,496,250	83,678,752	6,632,253
December	65,870,049	4,194,257	65,991,073	5,476,027
Total 12 months	986,480,610	52,551,048	951,024,441	64,982,249

Exports of mineral oil from the United States in years 1898–1901, by months—Continued.

Month.	1900.		1901.	
	Gallons.		*Gallons.*	
January	75,338,676	$6,339,185	85,531,751	$5,712,043
February	64,291,406	5,507,351	64,609,667	4,451,928
March	75,095,173	6,494,982	74,479,346	5,340,470
April	68,346,204	6,035,136	87,140,455	6,154,778
May	83,872,727	6,744,936	97,486,567	6,464,235
June	79,031,621	5,772,984	84,372,345	5,450,352
July	89,688,610	6,266,480	97,064,257	6,226,632
August	102,998,938	7,303,116	92,821,602	6,192,446
September	90,605,804	6,440,542	101,398,341	6,696,496
October	92,141,804	6,109,079	89,476,865	6,316,901
November	75,243,820	5,134,598	92,181,041	6,143,674
December	78,468,693	5,127,893	96,188,069	6,329,169
Total 12 months	975,123,476	73,276,282	1,062,750,306	71,479,124

The average distillation of 100 gallons of crude petroleum of the Pennsylvania oil fields is estimated to yield 76 gallons of illuminating oil; 11 gallons of gasoline, benzine, and naphtha; and 3 gallons of lubricating oils, while the remaining 10 gallons represent residuum and loss.

The following table exhibits the total production of crude petroleum in 1901, in barrels and gallons, also the separate derivatives exported and their value, together with their sum and value. This amount represents approximately 45 per cent of the total refined product that was obtained from the crude petroleum:

Quantity of crude petroleum produced in, and qualities and values of petroleum products exported from the United States during each of the calendar years from 1871 to 1901 inclusive.

Year ending December 31—	Production.		Exports.			
			Mineral, crude (including all natural oils, without regard to gravity).		Mineral, refined or manufactured.	
	Barrels (of 42 gallons).	Gallons.			Naphtha, benzine, gasoline, etc.	
			Gallons.		*Gallons.*	
1871	5,205,234	218,619,828	11,278,589	$2,171,706	8,396,905	$895,910
1872	6,293,194	264,314,148	16,363,975	2,761,094	8,688,257	1,307,058
1873	9,893,786	415,539,012	19,643,740	2,665,171	10,250,497	1,266,962
1874	10,926,945	458,931,690	14,430,851	1,428,494	10,616,644	997,355
1875	12,162,514	510,825,588	16,536,800	1,738,589	14,048,726	1,392,192
1876	9,132,669	383,572,098	25,343,271	3,343,763	13,252,751	1,502,498
1877	13,350,363	560,715,246	28,773,233	3,267,309	19,565,909	1,938,672
1878	15,396,868	646,668,456	24,049,604	2,169,790	13,431,782	1,077,402
1879	19,914,146	836,394,132	28,601,650	2,069,458	19,524,582	1,367,996
1880	26,286,123	1,104,017,166	36,748,116	2,772,400	15,115,131	1,344,529
1881	27,661,238	1,161,771,996	40,430,108	3,089,297	20,655,116	1,981,197
1882	30,510,830	1,281,454,860	45,011,154	3,373,302	16,969,839	1,304,041
1883	23,449,633	984,884,586	59,018,537	4,439,097	17,365,314	1,195,035
1884	24,218,438	1,017,174,396	79,679,395	6,102,810	13,676,421	1,132,528
1885	21,858,785	918,068,970	81,435,609	6,040,685	14,739,469	1,160,999
1886	28,064,841	1,178,723,322	76,346,480	5,068,409	14,474,951	1,264,736

Quantity of crude petroleum produced in, and qualities and values of petroleum products exported from the United States, etc.—Continued.

Year ending December 31—	Production.		Exports.			
	Barrels (of 42 gallons).	Gallons.	Mineral, crude (including all natural oils, without regard to gravity).		Mineral, refined or manufactured.	
					Naphtha, benzine, gasoline, etc.	
			Gallons.		*Gallons.*	
1887	28,283,483	1,187,906,286	80,650,286	$5,141,833	12,382,213	$1,049,043
1888	27,612,025	1,159,705,050	77,549,452	5,454,705	13,481,706	1,083,429
1889	35,163,513	1,476,867,546	85,189,658	6,134,002	13,984,407	1,208,116
1890	45,822,672	1,924,552,224	96,572,625	6,535,499	12,462,636	1,050,613
1891	54,291,980	2,280,263,160	96,722,807	5,365,579	11,424,993	868,137
1892	50,509,136	2,121,383,712	104,397,107	4,696,191	16,393,284	1,037,558
1893[a]	48,412,666	2,033,331,972	111,703,508	4,567,391	17,304,005	1,074,710
1894	49,344,516	2,072,469,672	121,926,349	4,415,915	15,555,754	943,970
1895	52,892,276	2,221,475,592	111,285,264	5,161,710	14,801,224	910,988
1896	[b]60,960,361	2,560,335,162	110,923,620	6,121,836	12,349,319	1,059,542
1897	[b]60,475,516	2,539,971,672	121,488,726	5,020,968	13,430,320	994,781
1898	[b]55,364,233	2,325,297,786	114,915,082	4,764,111	17,026,626	1,053,231
1899	[b]57,070,850	2,396,975,700	117,683,967	5,957,829	17,904,015	1,557,607
1900[c]	63,620,529	2,672,062,218	137,501,160	7,310,270	18,262,744	1,648,069
1901	69,389,194	2,914,346,148	124,648,930	6,015,131	20,713,873	1,644,983

Year ending December 31—	Exports.			
	Mineral, refined or manufactured.			
	Illuminating.		Lubricating (heavy paraffin, etc.).	
	Gallons.		*Gallons.*	
1871	132,178,843	$33,493,351	240,228	$92,408
1872	118,259,832	29,456,453	438,425	180,462
1873	207,595,988	41,357,686	1,502,503	517,466
1874	206,562,977	30,168,747	993,068	269,886
1875	203,678,748	28,168,572	938,052	265,837
1876	220,831,608	44,089,066	1,157,929	370,431
1877	307,373,842	51,366,205	1,914,129	577,610
1878	306,212,506	36,855,798	2,525,545	698,182
1879	365,597,467	32,811,755	3,168,561	713,208
1880	286,131,557	29,047,908	5,607,009	1,141,825
1881	444,666,615	42,122,683	5,053,862	1,165,605
1882	428,424,581	37,635,981	8,821,536	2,034,487
1883	440,150,660	39,470,352	10,108,394	2,193,245
1884	433,851,275	39,450,794	11,985,219	2,443,385
1885	445,880,518	39,476,082	12,978,955	2,659,210
1886	485,120,680	39,012,922	13,948,367	2,689,464
1887	485,242,107	37,007,336	20,582,613	3,559,280
1888	455,045,784	37,236,111	24,510,437	4,215,449
1889	551,769,666	41,215,192	27,903,267	4,638,724

[a] Exports are for fiscal years from 1893 to 1896, inclusive.

[b] In addition to this amount, 4,325 barrels of crude oil were produced in Kentucky and Tennessee in 1896, 4,377 barrels in 1897, 19,125 barrels in 1898, and 13,578 barrels in 1899, for which, as none was sold or used, no value could be given.

[c] Includes 41,405 barrels of oil sold in Kentucky and Tennessee in 1900, but produced in previous years.

Quantity of crude petroleum produced in, and qualities and values of petroleum products exported from the United States, etc.—Continued.

Year ending December 31—	Exports.			
	Mineral, refined or manufactured.			
	Illuminating.		Lubricating (heavy paraffin, etc.).	
	Gallons.		*Gallons.*	
1890	550,873,438	39,826,086	32,090,537	4,766,850
1891	531,445,099	34,879,759	33,310,264	4,999,978
1892	589,418,185	31,826,545	34,026,855	5,130,643
1893[a]	642,239,816	31,719,404	32,432,857	4,738,892
1894	730,368,626	30,676,217	40,190,577	5,449,000
1895	714,859,144	34,706,844	43,418,942	5,867,477
1896	716,455,565	48,630,920	50,525,530	6,556,775
1897	795,919,525	46,229,579	51,228,284	6,478,479
1898	761,152,107	38,542,082	63,968,341	7,385,054
1899	724,562,993	48,466,200	69,329,188	8,344,735
1900	730,585,487	53,933,556	68,997,715	9,542,618
1901	817,375,844	52,715,656	73,031,127	9,878,224

Year ending December 31—	Exports.			
	Residuum (tar, pitch, and all other, from which the light bodies have been distilled).		Total.	
	Gallons.		*Gallons.*	
1871	101,052	$10,450	152,195,617	$36,663,825
1872	568,218	56,618	144,318,707	33,761,685
1873	1,377,180	117,595	240,369,908	45,924,880
1874	2,504,628	177,794	235,108,168	33,042,276
1875	2,323,986	169,671	237,526,312	31,734,861
1876	2,863,896	239,461	263,449,455	49,545,219
1877	4,256,112	390,077	361,883,225	57,539,873
1878	3,126,816	220,835	349,346,253	41,022,007
1879	4,827,522	273,050	421,719,782	37,235,467
1880	3,177,630	198,983	346,779,443	34,505,645
1881	3,756,018	197,321	514,561,719	48,556,103
1882	4,265,352	275,263	503,492,462	44,623,074
1883	6,502,524	465,350	533,145,429	47,763,079
1884	5,303,298	327,599	544,495,608	49,457,116
1885	5,713,908	334,767	560,784,459	49,671,743
1886	1,993,824	109,673	591,884,302	48,145,204
1887	2,989,098	141 350	601,846,317	46,898,842
1888	1,870,596	116,009	572,457,975	48,105,703
1889	1,858,458	97,265	680,705,456	53,293,299
1890	1,830,612	91,905	693,829,848	52,270,953
1891	1,002,414	61,382	673,905,577	46,174,835
1892	403,032	38,220	744,638,463	42,729,157
1893[a]	541,044	41,661	804,221,230	42,142,058
1894	211,008	14,704	908,252,314	41,499,806
1895	137,508	13,063	884,502,082	46,660,082
1896	204,960	14,330	890,458,994	62,383.403
1897	12,230,902	333,740	994,297,757	59,057,547
1898	29,418,454	806,570	986,480,610	52,551,048
1899	21,544,278	655,878	951,024,441	64,982,249
1900	19,776,370	841,769	975,123,476	73,276,282
1901	26,980,532	1,225,127	1,062,750,306	71,479,124

[a] Exports are for fiscal years from 1893 to 1896, inclusive.

FOREIGN MARKETS.

The following table gives the number of gallons exported to the various foreign countries from 1894 to 1901. It will be noticed that Europe consumed over 70 per cent of the illuminating petroleum exported, and that the United Kingdom, Germany, and the Netherlands consume over 78 per cent of this amount. The United Kingdom consumes over 30 per cent, Germany 25 per cent, and the Netherlands 23 per cent, approximately.

During this period, covering eight years, the quantity exported to the United Kingdom has gradually decreased, with the exception of 1901, owing to the sharp competition of the cheaper and inferior products from Russia. The export to Germany and the Netherlands has generally been well maintained.

France, owing to the high duty on the refined product, is a heavy importer of the crude article, as also, to a lesser extent, are Spain and Mexico. The United Kingdom is also the heaviest consumer of lubricating petroleum, having consumed nearly 50 per cent of the total amount sold in Europe for the last eight years.

In the following table is given a statement showing the foreign markets for our oil in the last eight years. As will be seen from this table, the total exports of illuminating oils were decreased slightly in 1901.

Exports of petroleum in its various forms from the United States from 1894 to 1901, inclusive, by countries.

[Gallons.]

Country and kind.	Year ending June 30—			
	1894.	1895.	1896.	1897.
CRUDE.				
Europe:				
France	84,434,953	72,802,459	79,242,152	100,153,929
Germany	4,877,593	3,966,870	817,212	2,430,249
Netherlands			4,455,469	2,400,000
Spain	15,176,034	15,188,547	12.869,235	12,049,778
United Kingdom		3,997,013		
Other Europe	2,009,727	2,590,441	1,212,528	1,345,360
Total	106,498,307	98,545,330	98,596,596	118,379,316
North America:				
Mexico	8,026,189	5,229,983	6,779,059	7,090,850
Cuba	6,865,549	6,980,372	4,838,657	4,772,589
Other North America	534,304	523,579	708,008	623,958
Total	15,426,042	12,733,934	12,325,724	12,487,397
South America:				
Brazil				841,140
All other countries	2,000	6,000	1,300	18,390
Total crude	121,926,349	111,285,264	110,923,620	131,726,243

Exports of petroleum in its various forms from the United, etc.—Continued.

Country and kind.	Year ending June 30—			
	1894.	1895.	1896.	1897.
REFINED.				
Naphtha.				
Europe:				
France	3,764,569	1,564,360	1,672,056	2,103,725
Germany	4,278,757	4,900,028	2,814,217	2,800,883
Netherlands	....	....	....	1,400,000
United Kingdom	6,834,760	7,343,355	7,236,285	7,125,371
Other Europe	364,135	577,378	160,658	281,541
Total	15,242,221	14,385,121	11,883,216	13,711,520
North America	106,454	145,970	208,249	256,869
West Indies	67,195	84,299	104,062	83,529
South America	79,777	135,752	96,020	67,178
Asia and Oceania	57,057	45,217	49,927	120,479
Africa	3,050	4,865	7,845	9,453
Total	313,533	416,103	466,103	537,508
Total naphtha	15,555,754	14,801,224	12,349,319	14,249,028
Illuminating.				
Europe:				
Belgium	36,312,974	35,385,765	35,413,132	42,437,133
Denmark	9,290,251	14,626,436	12,693,927	14,001,755
France	11,812,001	6,204,663	5,338,501	2,736,190
Germany	86,388,785	100,829,413	121,841,266	114,583,356
Italy	22,945,037	28,017,572	22,648,184	24,525,066
Netherlands	31,868,189	45,900,640	122,510,644	126,341,441
Sweden and Norway	9,848,074	24,623,246	10,582,677	18,961,261
United Kingdom	274,555,010	279,064,424	181,883,052	185,200,507
Portugal	....	....	4,286,732	4,712,019
Other Europe	7,232,024	6,586,826	3,862,377	2,488,975
Total	490,252,345	541,238,985	521,060,492	535,987,703
North America:				
British North America	8,218,417	7,621,352	9,141,934	9,071,814
Central America	....	....	1,371,502	1,201,053
Mexico	....	....	241,061	335,692
West Indies—				
British	4,174,856	4,109,358	2,712,126	2,661,734
Other			2,189,271	2,218,373
Other North America	1,759,565	1,501,157	60,864	63,548
Total	14,152,838	13,231,867	15,716,758	15,552,214
South America:				
Argentina	3,162,846	5,876,742	7,803,218	9,703,792
Brazil	12,154,709	15,315,196	18,490,043	19,819,941
Chile	....	....	4,325,915	3,622,300
Uruguay	2,520,571	3,898,514	3,622,810	2,821,420
Venezuela	....	....	1,483,127	1,456,472
Other South America	5,503,680	7,245,123	2,784,155	3,049,493
Total	23,341,806	32,335,575	38,509,268	40,473,418

Exports of petroleum in its various forms from the United States, etc.—Continued.

Country and kind.	Year ending June 30—			
	1894.	1895.	1896.	1897.
Asia:				
China	40,377,296	18,022,800	25,694,890	42,516,120
Hongkong	16,888,820	10,595,610	10,499,000	14,977,050
East Indies—				
British	85,907,557	46,680,054	24,762,150	19,276,390
Dutch			16,947,830	24,898,000
Japan	37,272,450	24,298,170	33,701,038	46,252,501
Other Asia	....	....	....	5,085,030
Total	180,446,123	99,596,634	111,604,908	153,005,091
Oceania:				
British Australasia	11,821,881	14,686,752	13,721,827	15,329,222
Hawaiian Islands	....	....	629,740	391,150
Other Oceania	2,944,958	3,636,230	4,931,965	623,490
Total	14,766,839	18,322,982	19,283,532	16,343,862
British Africa	7,049,455	9,676,741	10,280,607	4,851,040
Other Africa	329,220	456,360	....	5,137,298
Total illuminating	730,338,626	714,859,144	716,455,565	771,350,626
Lubricating.				
Europe:				
Belgium	2,931,204	2,679,832	4,078,951	3,784,941
France	3,050,544	3,271,804	5,165,586	4,225,199
Germany	5,637,471	5,378,398	5,990,561	6,877,196
Italy	1,356,340	1,381,587	1,324,994	1,550,688
Netherlands	2,346,896	2,641,209	2,724,546	2,840,832
United Kingdom	19,668,767	21,209,497	23,436,081	21,301,290
Other Europe	415,385	520,025	815,017	1,011,201
Total	35,406,607	37,082,352	43,535,736	41,591,347
North America	1,308,586	1,248,751	1,244,538	1,259,249
West Indies	417,123	316,274	213,304	114,942
South America	1,509,708	2,159,844	2,221,780	1,876,794
Asia and Oceania	1,433,191	2,438,975	3,000,471	4,879,886
Africa	115,359	172,746	309,701	477,127
Total	4,783,967	6,336,590	6,989,794	8,607,998
Total lubricating	40,190,574	43,418,942	50,525,530	50,199,345
Residuum (barrels).				
Europe	2,056	2,099	4,248	140,777
North America	2,460	1,045	438	566
All other countries	513	130	194	1,269
Total residuum	5,029	3,274	4,880	142,612

Exports of petroleum in its various forms from the United States, etc.—Continued.

Country and kind.	Year ending June 30—			
	1898.	1899.	1900.	1901.
CRUDE.				
Europe:				
France	85,125,657	83,630,510	95,603,800	108,993,721
Germany	3,585,777	3,485,360	3,536,491	4,214,041
Netherlands	2,400,000	2,409,040	3,328,764	....
Spain	9,914,851	9,723,420	16,127,318	10,229,755
United Kingdom	5,060	310	....	2,547,501
Other Europe	136,314	2,391,864	138,628	255,256
Total	101,167,659	101,640,504	118,735,001	126,240,274
North America:				
Mexico	7,713,859	7,969,871	8,002,845	8,356,258
Cuba	3,829,463	3,297,175	5,935,494	3,584,240
Porto Rico	....	160,000	211,503	....
Other North America	585,390	20,510	136,033	246,583
Total	12,128,712	11,447,556	14,285,875	12,187,081
South America	1,026	....	....	....
All other countries	....	....	2,780	21,075
Total crude	113,297,397	113,088,060	133,023,656	138,448,430
REFINED.				
Naphtha.				
Europe:				
France	1,713,646	1,517,758	4,776,290	4,146,165
Germany	6,135,309	4,716,306	6,803,632	4,940,546
Netherlands	1,500	1,477,034	2,030,232	....
United Kingdom	7,380,140	7,584,526	7,356,743	7,340,307
Other Europe	382,201	414,597	420,706	290,454
Total	15,612,796	15,710,221	21,387,603	16,717,472
North America	290,372	251,879	241,340	382,536
West Indies	18,261	15,864	20,479	318,185
South America	85,492	137,743	95,314	145,848
Asia and Oceania	231,487	120,123	228,228	245,152
Africa	14,521	16,955	15,129	25,061
Total	640,133	542,564	600,490	1,116,782
Total naphtha	16,252,929	16,252,785	21,988,093	17,834,254
Illuminating.				
Europe:				
Belgium	44,317,797	40,715,711	43,675,550	41,561,489
Denmark	18,969,052	17,548,051	18,236,065	16,066,427
France	5,875,777	3,994,908	3,962,328	3,022,129
Germany	137,981,137	115,124,570	124,542,723	136,399,456
Italy	18,705,089	19,750,201	17,534,620	21,402,629
Netherlands	134,204,836	138,188,341	121,135,337	127,113,407
Sweden and Norway	23,567,695	17,345,423	24,693,536	27,809,142
United Kingdom	179,160,587	178,796,530	146,477,760	169,548,529
Portugal	5,500,240	2,692,476	1,826,056	4,317,989
Other Europe	3,821,197	2,787,050	4,567,988	3,362,181
Total	572,103,407	536,943,261	506,651,963	550,603,378

Exports of petroleum in its various forms from the United States, etc.—Continued.

Country and kind.	Year ending June 30—			
	1898.	1899.	1900.	1901.
REFINED—continued.				
Illuminating—Continued.				
North America:				
British North America	9,952,286	9,861,600	10,845,114	13,087,191
Central America	1,034,878	1,075,322	1,102,066	1,024,643
Mexico	550,544	581,222	282,160	225,172
West Indies—				
British	2,675,186	2,609,283	2,729,301	2,468,793
Other	2,234,338	2,899,504	2,592,440	3,229,659
Other North America	42,020	40,045	35,727	48,603
Total	16,489,252	17,066,976	17,586,808	20,084,061
South America:				
Argentina	10,648,733	6,483,293	10,182,529	10,644,774
Brazil	19,569,447	16,289,130	18,409,626	21,069,678
Chile	3,923,448	3,685,800	4,166,481	4,679,902
Uruguay	3,576,570	1,760,465	3,120,200	3,067,220
Venezuela	1,417,804	1,327,681	1,021,839	1,409,753
Other South America	2,820,834	2,760,223	3,029,520	3,092,790
Total	41,956,836	32,306,592	39,930,195	43,964,117
Asia:				
China	44,324,344	22,683,425	32,775,880	27,419,929
Hongkong	15,637,420	18,095,260	19,181,230	18,708,250
East Indies—				
British	33,341,284	20,109,900	9,906,240	10,712,570
Dutch	12,534,930	15,371,400	11,207,740	17,044,320
Other East Indies	....	....	....	585,580
Japan	51,621,050	32,705,180	51,297,805	53,299,686
Other Asia	4,119,840	155,700	2,412,770	529,200
Total	161,578,868	109,120,865	126,781,665	128,299,535
Oceania:				
British Australasia	18,859,348	14,396,782	19,542,573	23,136,046
Hawaiian Islands	785,740	1,049,210	1,217,780	....
Philippine Islands	....	....	....	1,208,100
Other Oceania	1,089,215	23,575	27,780	44,227
Total	20,734,303	15,469,567	20,788,133	24,388,373
British Africa	5,963,379	7,540,818	5,981,035	10,950,723
Other Africa	5,600,536	3,831,401	3,307,838	2,916,918
Total illuminatfng	824,426,581	722,279,480	721,027,637	781,207,105
Lubricating.				
Europe:				
Belgium	3,872,617	4,625,800	4,798,917	4,046,434
France	5,246,208	6,500,107	7,170,304	7,321,129
Germany	8,086,776	8,233,910	10,279,660	8,921,513
Italy	1,970,890	1,921,123	2,084,206	1,965,691
Netherlands	4,196,352	4,332,727	5,223,275	4,850,272
United Kingdom	25,724,836	26,353,051	28,669,308	26,762,400
Other Europe	920,919	1,755,551	1,882,200	1,675,564
Total	50,018,598	53,722,269	60,107,870	55,543,003

Exports of petroleum in its various forms from the United States, etc.—Continued.

Country and kind.	Year ending June 30—			
	1898.	1899.	1900.	1901.
REFINED—continued.				
Lubricating—Continued.				
North America	1,429,468	1,549,299	1,932,313	2,198,465
West Indies	186,285	416,680	308,429	417,532
South America	1,971,050	2,899,295	2,488,018	2,282,039
Asia and Oceania	5,978,725	7,737,421	9,244,955	10,413,188
Africa	715,239	1,099,421	502,184	603,378
Total	10,280,767	13,702,124	14,475,899	15,914,602
Total lubricating	60,299,365	67,424,393	74,583,769	71,457,605
Residuum (*barrels*).				
Europe	471,604	724,241	389,919	607,778
North America	1,680	5,299	2,894	12,873
All other countries	2,278	674	3,120	1,887
Total residuum	475,562	730,214	395,933	622,538

AVERAGE PRICE FOR REFINED OIL.

In the following tables the prices per gallon of refined oils of 70° Abel test are given:

Weekly prices of refined petroleum in the United States in 1901, in bulk and cases, at New York and Philadelphia.

[Cents per gallon.]

Week ending—	Refined.			Week ending—	Refined.		
	New York.		Philadelphia.		New York.		Philadelphia.
	Bulk.	Cases.	Bulk.		Bulk.	Cases.	Bulk.
January 5	5.05	8.75	7.55	July 6	4.35	8.00	6.85
January 12	5.15	8.85	7.65	July 13	4.35	8.00	6.85
January 19	4.90	8.60	7.40	July 20	4.95	8.00	7.45
January 26	4.90	8.60	7.40	July 27	4.95	8.00	7.45
February 2	5.05	8.75	7.55	August 3	4.95	8.60	7.45
February 9	5.25	8.95	7.75	August 10	4.95	8.60	7.45
February 16	5.25	8.95	7.75	August 17	4.95	8.60	7.45
February 23	5.50	9.10	7.90	August 24	4.95	8.60	7.45
March 2	5.50	9.10	7.90	August 31	4.95	8.60	7.45
March 9	5.50	9.10	7.90	September 7	4.95	8.60	7.45
March 16	5.50	9.20	8.00	September 14	4.95	8.60	7.45
March 23	5.50	9.20	8.00	September 21	4.95	8.60	7.45
March 30	5.50	9.20	8.00	September 28	4.95	8.60	7.45
April 6	5.20	8.90	7.70	October 5	5.10	8.60	7.60
April 13	5.10	8.80	7.60	October 12	5.10	8.75	7.60
April 20	5.10	8.80	7.60	October 19	5.10	8.75	7.60
April 27	4.95	8.65	7.45	October 26	5.10	8.75	7.60
May 4	4.70	8.35	7.20	November 2	5.10	8.75	7.60
May 11	4.60	2.25	7.10	November 9	5.10	8.75	7.60
May 18	4.35	8.00	6.85	November 16	5.10	8.75	7.60
May 25	4.35	8.00	6.85	November 23	5.10	8.75	7.60
June 1	4.35	8.00	6.85	November 30	5.10	8.75	7.60
June 8	4.35	8.00	6.85	December 7	5.10	8.75	7.60
June 15	4.35	8.00	6.85	December 14	5.10	8.75	7.60
June 22	4.35	8.00	6.85	December 21	4.80	8.55	7.60
June 29	4.35	8.00	6.85	December 28	4.80	8.55	7.60

PRODUCTION BY FIELDS, STATES, AND DISTRICTS.

The detailed results of the petroleum operations in the Appalachian oil field in 1900, by States, fields, and districts, and in the Lima-Indiana field, are presented in the pages that follow. A portion of both these fields is embraced within the geographical limits of Ohio, and the discussion of production, wells, etc., for both will be found under the head of Ohio.

APPALACHIAN OIL FIELD.

The most important new development in 1901 was in Ohio, in Monroe and Washington counties, where a large new production was secured from the Keener and Big Injun sands. There was a series of smaller pools developed in Perry and Morgan counties. The production in the Appalachian or white-sand pool in Ohio in 1901 was almost identical with that of 1900. All of the other States, excepting Kentucky and Tennessee, showed a decrease, amounting to 7.25 per cent in New York, 4.77 in Pennsylvania, and 12.46 in West Virginia. The pro ducers in this older field generally applied themselves to the more economical production of petroleum. Old wells were cleaned out and rigged up, which the more economical source of power secured in the natural-gas engine made it profitable to pump. Greater efforts were also made to keep the walls of the producing sand free from paraffin by the use of hot water and steam, and thereby increase their output. Occasionally they were torpedoed with a light shot and thoroughly cleaned out before pumping began again.

PRODUCTION OF THE APPALACHIAN FIELD FROM 1889 TO 1901, INCLUSIVE, BY STATES.

The following table exhibits the production of the several States in the Appalachian field. It is impossible to separate New York and Pennsylvania completely. It will be noticed that the production for the last ten years is remarkably regular, although there is considerable variation in the States that make up the totals. The figures have been slightly increased over those reported for last year, owing to the addition of the Kentucky and Tennessee pools.

Production of petroleum in the Appalachian oil field from 1889 to 1901, inclusive.

[Barrels of 42 gallons.]

Year.	Pennsylvania and New York.	West Virginia.	Southeastern Ohio.	Kentucky and Tennessee.	Total.
1889	21,487,435	544,113	318,277	5,400	22,355,225
1890	28,458,208	492,578	1,116,521	6,000	30,073,307
1891	33,009,236	2,406,218	424,323	9,000	35,848,777
1892	28,422,377	3,810,086	1,193,414	6,500	33,432,377
1893	20,314,513	8,445,412	2,602,965	3,000	31,365,890
1894	19,019,990	8,577,624	3,184,310	1,500	30,783,424
1895	19,144,390	8,120,125	3,694,624	1,500	30,960,639
1896	20,584,421	10,019,770	3,366,031	1,680	33,971,902
1897	19,262,066	13,090,045	2,877,838	322	35,230,271
1898	15,948,464	13,615,101	2,148,292	5,568	31,717,425
1899	14,374,512	13,910,630	4,764,934	18,280	33,068,356
1900	14,559,127	16,195,675	5,478,372	62,259	36,295,433
1901	13,831,996	14,177,126	5,471,790	137,259	33,618,171

The above table shows a decrease in production of 7.37 per cent in 1901 as compared with 1900. The production of 1900 was greater by 9.6 per cent than that of 1899. There was a falling off in West Virginia of over 2,018,549 barrels, amounting to 12.46 per cent. The total production corresponds closely to that of 1899.

PRODUCTION IN THE APPALACHIAN FIELD, BY MONTHS AND YEARS.

In the following table is given the production of crude petroleum in the Appalachian oil field from 1896 to 1901, by months:

Production of crude petroleum in the Appalachian oil field from 1896 to 1901, inclusive, by months and years.

[Barrels of 42 gallons.]

Month.	1896.	1897.	1898.	1899.	1900.	1901.
January	2,728,031	2,754,788	2,816,744	2,492,679	2,918,175	3,003,285
February	2,529,007	2,663,433	2,466,179	2,285,466	2,595,900	2,567,288
March	2,711,228	2,935,595	2,864,640	2,736,784	3,004,813	2,916,677
April	2,933,627	2,809,175	2,689,463	2,642,830	2,950,469	2,862,813
May	2,888,642	2,902,598	2,714,522	2,825,254	3,148,944	2,963,001
June	2,916,158	2,990,516	2,595,599	2,796,098	3,068,693	2,751,409
July	2,972,141	3,035,361	2,573,112	2,845,149	3,100,319	2,921,520
August	2,871,258	3,115,402	2,668,438	3,001,267	3,198,715	2,941,578
September	2,831,647	3,035,348	2,579.174	2,839,983	3,002,998	2,644,103
October	2,901,921	3,078,088	2,581,690	2,920,530	3,245,506	2,814,972
November	2,745,896	2,983,642	2,527,950	2,863,429	3,009,503	2,590,781
December	2,942,346	2,926,325	2,639,914	2,818,887	3,051,398	2,640,744
Total	33,971,902	35,230,271	31,717,425	33,068,356	36,295,433	33,618,171

PIPE-LINE RUNS OF THE APPALACHIAN FIELD.

In the following table will be found the pipe-line runs in the Appalachian oil field in 1901, by lines and by months:

Pipe-line runs in the Appalachian oil field in 1901, by lines and months.

[Barrels of 42 gallons.]

Month.	National Transit.	Southwest.	Eureka.	Tidewater.	Producers and Refiners' Pipe Line Company, Limited.	Elk.
January	547,409	359,636	1,287,574	134,036	103,538	15,652
February	432,021	325,525	1,107,161	107,837	89,650	14,507
March	548,894	363,107	1,212,318	127,602	106,212	15,473
April	557,296	357,313	1,173,041	133,945	102,594	15,041
May	547,649	364,598	1,239,287	130,142	100,027	14,800
June	515,629	330,605	1,178,319	118,605	93,419	14,471
July	530,255	351,251	1,271,851	123,112	104,168	15,199
August	528,152	329,718	1,264,314	118,344	102,288	14,350
September	496,599	300,316	1,107,380	108,866	97,111	14,221
October	538,391	319,213	1,182,648	118,761	98,377	14,465
November	487,585	307,091	1,062,834	106,758	94,632	13,480
December	477,715	310,489	1,056,999	117,522	118,441	14,621
Total	6,207,595	4,018,862	14,143,726	1,445,530	1,210,457	176,280

Month.	Emery.	United States.	Cumberland.[a]	Franklin.	Buckeye-Macksburg.	Total.
January	26,187	3,058	4,724	4,006	457,858	2,943,678
February	23,781	3,644	3,014	1,827	405,726	2,514,693
March	31,566	3,194	3,355	5,380	461,220	2,878,321
April	32,777	4,019	2,907	3,989	415,905	2,798,827
May	32,019	4,883	4,014	4,795	487,929	2,930,143
June	28,473	1,683	10,527	4,042	431,576	2,727,349
July	30,027	5,049	6,265	4,133	468,898	2,910,208
August	29,437	4,491	12,769	3,970	471,133	2,878,966
September	26,452	4,942	18,228	4,641	429,795	2,608,551
October	28,406	4,230	21,220	4,055	450,819	2,780,585
November	27,109	4,834	25,911	3,460	415,591	2,549,285
December	27,949	9,695	18,485	3,809	414,789	2,570,514
Total	344,183	53,722	131,419	48,107	5,311,239	33,091,120

[a] Includes runs of National Transit Company in Kentucky to December 1.

SHIPMENTS OF PETROLEUM FROM THE APPALACHIAN FIELD.

The following table gives the total deliveries or shipments of petroleum by the pipe lines from 1894 to 1901, inclusive, by years and months.

These figures represent the quantity of petroleum delivered out of their receiving tanks to customers, which in 1901 amounted to 36,481,726 barrels in the entire Appalachian field, 1,080,613 barrels more than the quantity delivered in 1900.

It will be seen in the tables that the shipments in 1901 amounted to 3,390,606 barrels more than the runs, which amount must be made up by drawing upon the stocks. Stocks on hand at the close of 1901 showed a decrease of 3,840,056 barrels, showing a difference of 449,450 barrels, which amount is passed to the credit of sediment and surplus account. This is maintained by the pipe-line companies in order to make up any losses that may occur by the formation of scale, sediment, or paraffin, or by the accumulation of water, which settles to the bottom of the tanks, forming a composition known as B. S., which is unsalable at the prices of fresh petroleum.

Total shipments of petroleum in the Appalachian oil field from 1894 to 1901, inclusive, by months.

[Barrels of 42 gallons.]

Month.	1894.	1895.	1896.	1897.
January	3,141,722	3,140,864	2,543,518	2,538,501
February	2,656,026	2,808,801	2,252,417	2,311,488
March	2,912,594	2,608,232	2,438,900	2,773,710
April	2,846,805	2,781,379	2,227,514	2,454,018
May	2,819,413	2,845,334	2,418,590	2,546,696
June	2,914,400	2,816,698	2,249,062	2,556,161
July	2,927,036	2,634,880	2,540,332	2,707,317
August	3,256,397	2,424,843	2,404,298	3,100,209
September	2,966,864	2,332,271	2,542,963	2,956,036
October	3,271,371	2,573,915	2,606,494	3,638,301
November	3,208,560	2,655,325	2,502,035	3,320,084
December	3,286,087	2,410,084	2,614,072	2,761,803
Average	3,017,273	2,669,386	2,445,016	2,805,360
Total	36,207,275	32,032,626	29,340,195	33,664,324

Total shipments of petroleum in the Appalachian oil field, etc.—Continued.

Month.	1898.	1899.	1900.	1901.
January	2,909,176	2,484,546	2,898,725	3,142,966
February	2,133,424	1,905,583	2,752,484	2,595,023
March	2,627,845	2,635,454	2,799,258	2,886,428
April	2,422,105	2,379,122	2,845,047	2,954,852
May	2,393,831	2,579,304	2,794,178	3,034,253
June	2,435,248	2,538,921	2,881,534	2,844,145
July	2,563,825	2,357,716	2,756,900	3,272,747
August	2,696,018	2,779,825	3,386,097	3,263,416
September	2,585,253	2,704,392	3,034,646	3,076,736
October	2,847,108	2,743,677	3,005,063	3,248,859
November	2,408,127	2,607,901	3,152,667	3,124,277
December	2,383,976	2,600,985	3,094,514	3,038,024
Average	2,533,828	2,526,452	2,950,093	3,040,144
Total	30,405,936	30,317,426	35,401,113	36,481,726

STOCKS OF PETROLEUM IN THE APPALACHIAN FIELD.

In the following table are given the stocks of petroleum in the tanks of the pipe-line companies in the Appalachian oil field at the close of each month for the past eight years:

Total stocks of petroleum in the Appalachian oil field at the close of each month from 1894 to 1901, inclusive.

[Barrels of 42 gallons.]

Month.	1894.	1895.	1896.	1897.
January	11,755,219	5,859,348	5,499,477	9,904,200
February	11,384,776	5,087,498	5,741,797	10,308,262
March	11,295,959	4,942,643	6,005,732	10,426,110
April	10,751,983	4,730,819	6,697,481	10,772,213
May	10,639,454	4,506,874	7,153,922	11,088,493
June	10,381,209	4,275,506	7,791,359	11,485,001
July	9,869,915	4,306,287	8,182,582	11,830,322
August	9,210,959	4,592,906	8,672,385	11,794,707
September	8,730,456	4,908,593	8,924,639	11,872,575
October	8,038,376	5,013,941	9,178,509	11,246,836
November	7,283,988	4,988,092	9,409,098	10,870,883
December	6,499,880	5,344,784	9,745,722	11,010,044
Average	9,653,515	4,879,775	7,750,225	11,050,804

Total stock of petroleum in the Appalachian oil field, etc.—Continued.

Month.	1898.	1899.	1900.	1901.
January	10,851,673	11,722,555	13,383,404	13,248,646
February	11,170,947	12,034,804	13,147,351	13,163,049
March	11,370,864	12,054,356	13,305,549	13,152,468
April	11,611,688	12,301,840	13,351,327	12,993,124
May	11,909,904	12,497,709	13,632,248	12,869,465
June	12,052,282	12,702,241	13,752,630	12,758,268
July	11,976,516	13,067,316	14,041,007	12,389,863
August	11,908,617	13,155,777	13,851,685	11,979,736
September	11,852,553	13,150,046	13,519,681	11,408,567
October	11,490,444	13,199,969	13,668,955	10,859,058
November	11,572,734	13,365,565	13,413,177	10,212,579
December	11,786,603	13,451,191	13,475,548	9,635,492
Average	11,629,569	12,725,281	13,545,214	12,055,858

The year 1901 shows a gradual decline in the amount of crude petroleum held in stock, amounting to 3,840,056 barrels, in the Appalachian field. If this amount be added to the production of the field during the year it makes the consumption 37,458,227 barrels, the largest on record. It will be noticed that the smallest amount of stocks in any one year since 1894 was in 1895, when there were but 5,344,784 barrels carried over in iron tanks by the pipe-line companies.

PRICES OF CRUDE PETROLEUM IN THE APPALACHIAN FIELD.

The average prices cover the ordinary grades of oil. They do not include special oils, such as that from the Franklin lubricating district, nor that of Petroleum and Volcano of West Virginia, nor that of the Mecca-Belden district of Ohio; but only such oil as Pennsylvania oil, used chiefly for the production of illuminants. It is also true that in some of the districts oil is worth more than ordinary Pennsylvania oil, and in some districts it is worth less. This is owing to the fact that some districts produce oil that furnishes a larger percentage of illuminating oil and also a larger percentage of by-products. Petroleum that has remained in tanks at the wells for a long period loses a percentage of its illuminating properties, and is worth less than what is known as fresh oil or petroleum recently produced at the wells.

These averages, it should be understood, are not the true averages—that is, averages that consider the price and the quantity sold at that price—but they are the averages of the prices obtained for certificates or for oil at the primary markets from day to day. It is probable that the true average prices would be slightly under the averages obtained by averaging the prices. The figures given in the tables following are, under these conditions, the only ones that can be ascertained, and do not vary much from the true average:

Monthly and yearly average prices of pipe-line certificates of Pennsylvania crude petroleum at wells from 1860 to 1901, inclusive.

[Per barrel of 42 gallons.]

Year.	January.	February.	March.	April.	May.	June.
1860	$19.25	$18.00	$12.62½	$11.00	$10.00	$9.50
1861	1.00	1.00	1.00	.62½	.50	.50
1862	.10	.15	.22½	.50	.85	1.00
1863	2.25	2.50	2.62½	2.87½	2.87½	3.00
1864	4.00	4.37½	5.50	6.56	6.87½	9.50
1865	8.25	7.50	6.00	6.00	7.37½	5.62½
1866	4.50	4.40	3.75	3.95	4.50	3.87½
1867	1.87½	1.85	1.75	2.07½	2.35	1.90
1868	1.95	2.00	2.55	2.82⅛	3.75	4.50
1869	5.75	6.95	6.00	5.70	5.35	4.95
1870	4.52½	4.52½	4.45	4.22½	4.40	4.17½
1871	3.82½	4.38	4.25	4.01	4.60	3.85½
1872	4.02½	3.80	3.72½	3.52½	3.80	3.85
1873	2.60	2.20	2.12½	2.30	2.47½	2.22½
1874	1.20	1.40	1.60	1.90	1.62½	1.32½
1875	1.03	1.52½	1.75	1.36½	1.40	1.26½
1876	1.80	2.60	2.01	2.02½	1.90½	2.01¾
1877	3.53¼	2.70	2.67½	2.58	2.24	1.94⅝
1878	1.43	1.65¼	1.59	1.37½	1.35¼	1.14
1879	1.03	.98	.86¼	.78½	.76	.68⅜
1880	1.10¼	1.03⅛	.88¾	.78	.80	1.00
1881	.95½	.90⅜	.83⅜	.86¼	.81⅞	.81¼
1882	.83⅛	.84½	.81⅜	.78⅜	.71½	.54⅜
1883	.93¾	1.01	.97⅝	.94⅜	1.00⅛	1.16⅜
1884	1.11	1.04⅜	.98⅛	.94	.85⅝	.68⅝
1885	.70⅞	.72⅜	.80⅜	.78½	.79	.82
1886	.88⅜	.79⅞	.77¼	.74⅞	.70	.66½
1887	.70	.64⅝	.63⅜	.64⅞	.64½	.62⅝
1888	.91¼	.91⅝	.98⅝	.82⅝	.86¾	.75⅞
1889	.86⅝	.89¼	.90⅞	.88	.83⅛	.83⅞
1890	1.05¾	1.05⅛	.90	.82⅝	.88⅞	.89¼
1891	.74¼	.78⅜	.74¼	.71½	.69¾	.68⅛
1892	.62⅜	.60¼	.57⅛	.57⅞	.57⅜	.54⅛
1893	.53½	.57⅜	.65¼	.68¾	.58¾	.60¼
1894	.79¾	.80⅝	.82	.84¼	.86	.89⅜
1895	.99	1.04⅜	1.09¾	1.79	1.74¼	1.53⅝
1896	1.42⅝	1.36⅝	1.28½	1.22½	1.15⅜	1.14¾
1897	.88	.90½	.92⅛	.85⅞	.86¾	.86¼
1898	.65	.67¾	.78⅝	.73¾	.82¼	.87⅛
1899	1.17	1.15	1.13	1.13	1.13	1.13¼
1900	1.66⅝	1.68	1.68	1.55	1.39⅜	1.25½
1901	1.19½	1.25	1.29	1.20½	1.07⅝	1.05

Monthly and yearly average prices of pipe-line certificates of Pennsylvania crude petroleum, etc.—Continued.

Year.	July.	August.	September.	October.	November.	December.	Yearly average.
1860	$8.62½	$7.50	$6.62½	$5.50	$3.75	$2.75	$9.59
1861	.50	.25	.20	.10	.10	.10	.49
1862	1.25	1.25	1.25	1.75	2.00	2.25	1.05
1863	3.25	3.37½	3.50	3.75	3.85	3.95	3.15¾
1864	12.12½	10.12½	8.87½	7.75	10.00	11.00	8.06
1865	5.12½	4.62½	6.75	8.12½	7.25	6.50	6.59
1866	3.00	3.75	4.50	3.39	3.10	2.12½	3.74
1867	2.62½	3.15	3.40	3.55	2.50	1.87½	2.41
1868	5.12½	4.57½	4.00	4.12½	3.75	4.35	3.62½
1869	5.37½	5.57½	5.50	5.50	5.80	5.12½	5.63¾
1870	3.77½	3.15	3.25	3.27½	3.22½	3.40	3.86
1871	4.79	4.66	4.65	4.82½	4.25	4.00	4.34
1872	3.80	3.58½	3.25	3.15	3.83½	3.32½	3.64
1873	2.00	1.42½	1.15	1.20	1.25	1.00	1.83
1874	1.02½	.95	.95	.85	.55	.61½	1.17
1875	1.09	1.13	1.33	1.32½	1.44	1.55	1.35
1876	2.24½	2.71⅜	3.81	3.37½	3.11	3.73	2.56¼
1877	2.07½	2.51	2.38	2.56¾	1.91	1.80	2.42
1878	.98¾	1.01	.86⅝	.82½	.89⅜	1.16	1.19
1879	.69⅞	.67⅛	.69⅜	.88½	1.05⅝	1.18½	.85⅞
1880	1.06¼	.91	.96	.96⅞	.91⅞	.91⅝	.94½
1881	.76⅞	.78⅛	.97⅛	.91¼	.85¼	.84⅜	.85⅞
1882	.57⅜	.58⅝	.72⅛	.93¾	1.14	.96	.78⅛
1883	1.05⅞	1.08	1.12½	1.11⅛	1.14½	1.14¾	1.05¾
1884	.63½	.81⅞	.78	.71⅛	.72½	.74⅜	.83½
1885	.92½	1.00¼	1.00¾	1.05½	1.04⅜	.89⅝	.87⅞
1886	.66	.62⅛	.63⅜	.65⅛	.71⅝	.70⅝	.71¼
1887	.59¼	.60⅛	.67	.70⅞	.73⅞	.80¾	.66¾
1888	.80⅝	.90⅛	.93⅝	.90⅝	.85⅜	.89¼	.87⅝
1889	.95⅛	.99½	.99⅛	1.01⅜	1.08½	1.04½	.94⅛
1890	.89⅛	.89¼	.81⅞	.80⅛	.72⅜	.67¼	.86¾
1891	.66½	.64	.58½	.60½	.58¾	.59⅝	.67
1892	.52½	.55	.54⅜	.51⅜	.52	.53¼	.55⅝
1893	.57⅝	.58⅞	.64⅝	.70¾	.73⅞	.78¼	.64
1894	.83⅛	.81	.83	.83	.83	.91½	.83⅞
1895	1.46⅝	1.26⅛	1.22⅜	1.24¼	1.48⅜	1.42	1.35⅞
1896	1.08¼	1.05	1.12	1.15	1.16	.98	1.17⅞
1897	.76¾	.71	.69¾	.67⅜	.65	.65	.78⅝
1898	.93¼	.97⅝	1.01¾	1.13⅛	1.16⅜	1.17½	.91⅛
1899	1.22⅜	1.27½	1.44½	1.50⅞	1.57⅜	1.65⅛	1.29⅜
1900	1.25⅝	1.25½	1.23	1.10⅜	1.06¾	1.08¾	1.35¼
1901	1.13⅜	1.25	1.25⅜	1.30	1.30	1.21	1.21

In the following tables are given the average monthly prices, during 1900 and 1901, of crude petroleum produced in the various districts of the Appalachian oil regions in which special prices are paid:

Average monthly prices of Appalachian crude petroleum, per barrel of 42 gallons, in 1900.

Month.	Tiona.	Pennsylvania.	Barnesville.	Corning.	Newcastle.
January	$1.81⅝	$1.66⅝	$1.56⅝	$1.49⅝	$1.41⅝
February	1.83	1.68	1.58	1.51	1.43
March	1.83	1.68	1.65	1.51	1.43
April	1.70	1.55	1.55	1.38	1.30
May	1.54⅜	1.39⅜	1.39⅜	1.22⅜	1.14⅜
June	1.40½	1.25½	1.25½	1.08½	1.00½
July	1.40⅝	1.25⅝	1.25⅝	1.08⅝	1.00⅝
August	1.40½	1.25½	1.25½	1.08½	1.00½
September	1.37¾	1.23	1.23	1.05¾	.97¾
October	1.25⅜	1.10⅜	1.10⅜	.93⅜	.85⅜
November	1.21¾	1.06¾	1.06¾	.89¾	.81¾
December	1.23¾	1.08¾	1.08¾	.91¾	.83¾
Average	1.50⅕	1.35¼	1.33¼	1.18⅕	1.10⅕

Average monthly prices of Appalachian crude petroleum, per barrel of 42 gallons, in 1901.

Month.	Tiona.	Pennsylvania.	Barnesville.	Corning.	Newcastle.
January	$1.34½	$1.19½	$1.19½	$1.02½	$0.94½
February	1.40	1.25	1.25	1.08	1.00
March	1.44	1.29	1.29	1.12	1.04
April	1.35½	1.20½	1.20½	1.03½	.95½
May	1.22⅝	1.07⅝	1.07⅝	.90⅝	.82⅝
June	1.20	1.05	1.05	.88	.80
July	1.28⅜	1.13⅜	1.13⅜	.96⅜	.88⅜
August	1.40	1.25	1.25	1.08	1.00
September	1.40⅜	1.25⅜	1.25⅜	1.08⅜	1.00⅜
October	1.45	1.30	1.30	1.13	1.05
November	1.45	1.30	1.30	1.13	1.05
December	1.36	1.21	1.21	1.04	.96
Average	1.36	1.21	1.21	1.04	.96

WELL RECORDS IN THE APPALACHIAN FIELD.

The following table shows the total number of wells completed each month in the several districts for 1901:

Total number of wells completed in the Appalachian oil field in 1901, by months and districts.

Month.	Bradford.	Allegheny.	Middle.	Venango and Clarion.	Butler and Armstrong.	Southwest district.	Southeastern Ohio.	Total.
January	17	25	50	61	40	310	86	589
February	7	13	22	46	30	297	91	506
March	7	23	30	61	33	241	84	479
April	11	36	46	81	36	249	130	589
May	17	45	41	104	45	270	151	673
June	25	37	49	85	50	303	143	692
July	35	46	41	76	43	292	122	655
August	27	52	43	123	40	296	146	727
September	39	44	53	120	40	295	138	729
October	30	45	42	121	59	294	121	712
November	24	55	41	117	67	322	140	766
December	25	34	32	87	51	255	108	592
Total	264	455	490	1,082	534	3,424	1,460	7,709

The number of wells drilled in 1900 was 8,845, which was 1,136 more than in 1901. The dry holes in 1901 amounted to 2,118, leaving 5,591 productive wells, as compared with 6,685 productive wells completed in 1900. There were, therefore, 1,094 more productive wells completed during 1900 than there were in 1901; so that there were 27 per cent dry in 1901, as compared with 24 per cent in 1900.

Total number of wells completed in the Appalachian oil field from 1892 to 1901, inclusive, by districts.

District.	Wells completed.									
	1892.	1893.	1894.	1895.	1896.	1897.	1898.	1899.	1900.	1901.
Bradford	37	52	284	578	769	696	488	642	404	264
Allegany	21	41	82	258	331	350	264	597	575	455
Middle	131	91	215	401	594	481	388	558	583	490
Venango and Clarion	131	243	731	1,783	1,614	990	772	1,535	1,494	1,082
Butler and Armstrong	342	298	755	1,292	1,153	802	497	699	764	534
Southwest	1,230	1,065	1,481	2,364	2,744	2,255	2,017	2,925	3,598	3,424
Southeastern Ohio	76	190	215	460	619	498	366	1,796	1,427	1,460
Total	1,968	1,980	3,763	7,136	7,824	6,072	4,792	8,752	8,845	7,709

In the above table only the southeastern Ohio district shows an increase, and that is very slight. The main increase in wells completed has for several years come from the large southwest district, which includes West Virginia and southwestern Pennsylvania.

The following table shows the wells completed, dry holes, wells productive, initial daily production, wells drilling, and the rigs building in the Appalachian field, by months, during 1901:

Well record in the Appalachian oil field in 1901.

Month.	Wells completed.	Dry holes.	Wells productive.	Initial production.	Wells drilling.	Rigs building.
				Barrels.		
January	589	167	422	10,568	614	327
February	506	160	346	7,585	532	358
March	479	134	345	6,724	552	378
April	589	172	417	8,314	587	370
May	673	167	506	8,202	550	386
June	692	186	506	8,002	601	351
July	655	183	472	8,710	626	308
August	727	200	527	8,324	629	340
September	729	214	515	6,770	621	338
October	712	175	537	7,329	653	378
November	766	215	551	7,892	671	378
December	592	145	447	6,282	635	344
Total	7,709	2,118	5,591	[a]7,892	[a]606	[a]355

[a] Average.

COLORADO.

There was remarkable activity all over the State in the latter half of 1901, and many wells were drilled in isolated localities. Toward the close of 1901 a well completed near Boulder, 30 miles northwest of Denver, caused renewed interest all over the State. Ten years ago a well was drilled by unknown persons near this locality, who got a showing of petroleum. They were probably attracted to this locality by the original geological map of Colorado, executed in 1877 under Prof. F. V. Hayden, of the U. S. Geological Survey of the Territories, which indicated geological formations at Boulder similar to those existing at Florence, and extending continuously, but much narrowed, in a northern direction into Wyoming. The McKenzie well, No. 1, got a showing of petroleum at about 2,720 feet in what is supposed to be the Pierre shales of the Montana division of Cretaceous. The operators had the misfortune to lose their tools, and were forced to abandon the well. The Arnold well was the next to find a considerable showing of petroleum at a depth of 2,850 feet, in a formation of sand associated with more or less slate, with a slight showing of iron pyrites. The McKenzie, No. 2, near the original No. 1 well, was the next one to find petroleum at about the same depth, and for some time it produced about 10 barrels per day. The petroleum secured by these two wells was the incentive for the organization of numerous stock companies and the investment of a large amount of capital along the foothills of the Rocky Mountains from Colorado Springs northward, along a line passing near Golden, Boulder, and Fort Collins, and extending to the Wyoming State line. So far the developments along this line have not been successful in finding petroleum in sufficient quantities to justify the drilling of such deep and expensive wells. The quality of the petroleum, however, is remarkable for its purity and its resemblance to the Pennsylvania petroleum. Its gravity, when first produced at the wells, is close to 42.5° Baumé, as the following analyses by Prof. R. G. Hoffman, president of the Pennsylvania Lubricating Company, of Bradford, Pa., and by Dr. Frederick Salathe will indicate.

Another analysis, given below, shows also that the quality of the petroleum secured at Boulder is all that could be desired.

Analysis of Boulder crude oil.

	Per cent.
Naphtha	17
Kerosene, 150° flash test	41
Signal stock, 280° flash test	7.5
Lubricating engine machine oil	11.5
Cylinder oil, 600° flash test	21.5
Loss in refining	1.5
Total	100

Specific gravity, 43° Baumé.

Analysis of Boulder oil from the McKenzie well, Boulder County, Colo.

Series.	Specific gravity.	Baumé.	Flash.	Fire.	Cold.	Percentage of naphtha and coal oil.
Naphtha series:		°				
1	0.70020	69.9				6
2	.73690	59.8				6
3	.75600	57.2	60			6
4	.77200	53.1	70			6
5	.78790	49.3	105	146		6
Coal-oil series:						
6	.80070	46.3	146	172		40
7	.81490	43.2	200	240		40
8	.82100	41.7	235	260		40
9	.82950	40	265	300		40
10	.83760	38.3	297	350	52–40	40
Reduced stock		26.8	410	470	90	40
Crude	.83040	39.8	0° F.	0° F.		

Commercial products.

Grade.	Specific gravity.	Flash.	Fire.	Cold.	Per cent.
	°	°	°	°	
Gasoline and naphtha	60				16
Coal oil	45		150		40
Lubricating stock	26.8	410	770	90	44
Total					100

To the east of the sharp eastern dip found next the lines of the foothills of the mountains, buried by many feet of strata in the great plains, there are no doubt localities more favorable for the accumulation of petroleum than those developed at Boulder and other similar localities, where the dips have flattened out and the strata are more or less gently folded, forming gentle anticlines and synclines. These may or may not be indicated upon the surface, and in the latter case the drill alone must determine the question of structure. The depth, however, necessary to reach the productive strata under the large area to the east of the present development at Boulder may be too great to allow development in an economical way by methods now in use. The quality of the petroleum found at Boulder is of such a nature that the temptation to prospect for it, even against the odds of deep and expensive drilling, is strong.

During the year 1901 there was a large amount of prospecting done and a number of wells drilled on the western side of the continental divide, in the mountainous portions of Colorado, the most prominent of which were the operations near Pagosa Springs, in Archuleta County, in southwestern Colorado. In this section there are several springs showing petroleum associated with hot sulphur water, and also gas springs. There are, according to Prof. Arthur Lakes, dykes of injected volcanic origin more or less saturated with petroleum. He also reports three horizons which show petroleum: "First, the same horizon as the Florence, viz, the Montana Cretaceous; secondly, in the Dakota group of the Cretaceous, over 1,000 feet below No .1; and thirdly, in the upper Carboniferous"—all of which have shown petroleum in greater or less quantity in Wyoming.

By the end of the year there were four wells drilling and two ready to start in this section located as follows: One well in sec. 13, T. 36 N., R. 1 W., 675 feet deep; one in sec. 19, T. 33 N., R. 1 E, 250 feet deep; one in sec. 14, T. 34 N., R. 1 W., 1,000 feet deep; and one in sec. 29, T. 35 N., R. 1 W., 800 feet deep. One was started in sec. 5, T. 32 N., R. 2 E., and another in sec. 13, T. 34 N., R. 3 W. The petroleum so far secured in this section has been poor in quality and small in quantity, being of an asphaltum base of 19° Baumé gravity, which, upon an experimental test, was found to yield no illuminants or other products commercially valuable. Should this quality of petroleum be found here in quantity it could be sold only to a limited extent for fuel, as it is far from any large market.

Toward the close of the year there were two operations in Rio Blanco County, near De Beque, on the Denver and Rio Grande Railroad on the western side of the continental divide. One of these at a depth of 600 feet yielded a small amount of remarkably pure petroleum of a dark yellow color and sweet odor, with a specific gravity of 40° Baumé. It is supposed to have had its source in the Laramine, or upper Cretaceous formation.

An exhaustive test, cutting off every 5 per cent, gave the following results: The first gave 5 per cent at 52.4° Baumé; the second 5 per cent at 48.5°; and the third 5 per cent at 44.6° Baumé; the fourth gave 5 per cent at 41.4° Baumé, and so on down. The distillate chilled at a high temperature, showing a large amount of amorphous paraffin, and notwithstanding the means at hand for extracting the paraffin were rather crude, a yield of 11.55 per cent of scale was secured, some of which has a very high melting point.

By the latter part of February, 1902, a reliable estimate put the number of organized companies at 422. Of these, 101 had derricks completed, and 48 wells were being drilled in Colorado. Three of this number at Boulder were producing petroleum in small quantities. The greatest activity was at Boulder, Fort Collins, and De Beque. The wells mentioned do not include any of those completed or drilling in the old Florence field.

The following list will convey some idea of the activity throughout the State:

Petroleum wells and derricks in Colorado at the close of February, 1902.

Localities.	Wells drilling.	Derricks.
Boulder	21	39
De Beque	6	20
Fort Collins	4	10
Pagosa Springs	5	8
Routt County	1	2
Gunnison County	1	4
Jefferson County	3	6
Arapahoe County	1	1
El Paso County	1	1
La Plata County	1	3
Saguache County	1	1
Elbert County	1	1
Logan County	1	4
Pueblo County	1	1
Total	48	101

PRODUCTION IN COLORADO.

The production of the State amounted to 460,520 barrels in 1901, all from the Florence district.

In the following table will be found a statement of the production of crude oil in Colorado from 1887 to 1901:

Production of crude oil in Colorado from 1887 to 1901, inclusive.

Year.	Quantity.
	Barrels.
1887	76,295
1888	297,612
1889	316,476
1890	368,842
1891	665,482
1892	824,000
1893	594,390
1894	515,746
1895	438,232
1896	361,450
1897	384,934
1898	444,383
1899	390,278
1900	317,385
1901	460,520
Total	6,456,025

The above table shows a large increase in the production for 1901, amounting to 143,135 barrels, which is 45 per cent over that of 1900, being the largest since 1894. All of the petroleum up to the close of the year came from the Florence field, and was nearly all sold to the refineries at that place.

The average price paid for the year was $1 per barrel, amounting to $461,000, as compared with $1.019 for 1900, which amounted in value for that year to $323,434. There was no petroleum sold from the new field at Boulder.

There were 35 wells drilled in the Florence field in 1901, 16 of which were dry. Five small producers were abandoned.

WYOMING.

There has been unusual activity during 1901 in all of the petroleum fields in Wyoming, which was no doubt stimulated by the remarkable discovery of new fields of petroleum in Texas and California.

The one particular event that seemed to create renewed interest was the finding, at a depth of 650 feet, of a remarkably pure petroleum, with a paraffin base, in a well located in Uintah County, sec. 27, T. 15 N., R. 118 W., drilled for water by the Union Pacific Railroad at Spring Valley in the early part of 1901. The production, however, was small, but the quality was all that could be desired, yielding by weight 17.1 per cent gasoline and naphtha, 33.4 per cent illuminating petroleum, 27.1 per cent heavy illuminating and headlight petroleum, 20.4 per cent of lubricating petroleum and paraffin, and leaving but 2 per cent for carbon and loss. The specific gravity was .81, equal to 43° Baumé.

During 1901 nearly all the available petroleum lands have been located, and probably a much larger area covered than will ever prove to be productive of petroleum in marketable quantities. This statement should, however, be explained, for in Wyoming, as in nearly all of the Western States, nearly all of the petroleum fields are upon Government lands, and, although the existence of oil has been known for over half a century, there are not over 5,000 to 6,000 acres of patented oil lands in the State at present, the greater part of these lands being held under placer claims, prescribed by the United States mining laws.

The General Land Office has taken important action with reference to the development of petroleum production in Wyoming, and has withdrawn from agricultural entry a large tract of land on the basis of reports which have just been made to the office by expert special agents relative to the finding of oil thereon in commercial quantities. Under the land laws of the United States, lands known to contain petroleum or minerals of any kind can not be taken on an agricultural entry, but lands entered in good faith for agricultural purposes upon which petroleum is subsequently found may, nevertheless, be retained by those who have entered them.

LOUISIANA.

After the discovery of petroleum in the Beaumont field, Texas, early in 1901, the hope of finding oil in the neighboring localities, especially in that portion of Louisiana near to Texas, attracted many prospectors to this State. Development work was commenced near Jennings, Welsh, Lake Charles, Sulphur, and a few places in adjoining parishes. The Jennings Oil Company, drilling in Acadia Parish, 87 miles east of Beaumont and 190 miles west of New Orleans on the line of the Southern Pacific Railroad, succeeded in finding oil in paying quantities. At first the well gave them considerable trouble. It was in very bad condition, 300 feet of pipe having been lost in the hole. The well, however, has proved a great gusher, having flowed for seven hours together 40 feet higher than the derrick. The casing was set in a sand 47 feet above the bottom of hole, which is 1,822 feet deep. The sand clogs the well, but when clean it always gushes. The smaller the diameter the more apt the well is to clog; larger diameters would no doubt develop much larger gushers that would free themselves of the loose sand. The Jennings Oil Company has at present writing (March 14, 1902) two good wells, and, although they have not been tested, it is estimated that their product will be from 2,000 to 2,500 barrels each per day. The Southern Oil Company early in 1902 completed a good well about 100 feet from the Jennings No. 1 well. These two companies are now building a 37,500-barrel tank and a pipe line 6 miles to the town of Jennings, besides a pumping plant, and it is expected that the product will be on the market by July 1.

The oil is black in color, contains less than 1 per cent sulphur, and is of lighter gravity than that of the Beaumont field. No analysis could be obtained. There is considerable showing of both petroleum and natural gas at Sulphur, at shallow depths, underneath which at about 450 feet beds of native sulphur are encountered associated with lime rock to a depth of 1,230 feet. This portion of Louisiana is in the line of disturbance reaching from Alabama into Texas.

TEXAS.[a]

BEAUMONT DISTRICT.

Probably no other event in the development of the petroleum industry in the United States caused such a profound sensation, reaching all of the interests connected with the production and sale of this article, as the unexpected outburst of a powerful gusher on the coastal plain of Texas, in sight of tide water, 4½ miles south of Beaumont.

INCEPTION OF THE INDUSTRY.

This well began to flow January 10, 1901, sending up a solid 6-inch stream 160 feet in height almost continuously. Each day seemed to add increased volume of output until it was capped and shut in, nine days afterwards. Not until it was proved that petroleum produced by this gusher was 22° Baumé, or 0.920 gravity, and contained a large proportion of sulphur, was confidence restored to the producers in the Eastern petroleum fields.

It, however, proved the existence of a reservoir of unusual productive capacity within easy reach of cheap transportation. This very remarkable well, located by Capt. A. F. Lucas, and completed by himself and his associates, Mr. J. M. Guffey and Mr. John H. Galey, probably flowed more than 500,000 barrels before being capped. The output, if anything, was greater toward the close of the nine days than at first, and conservative estimates have placed the flow at 70,000 barrels per day. If the diameter had been 10 or 14 inches instead of 6 inches, it would have more than equaled the largest gushers of the Russian field.

Two unsuccessful attempts were made in former years to put down a test well in this locality, but for want of proper appliances and experience they proved failures. Explorers and prospectors were attracted to this locality by the existence of several small flows of natural gas that were known for many years near the summit of an elliptical mound of 15 to 18 feet of elevation above the surrounding flat surface of the coastal plain. There were also several springs in this locality, the water of which was strongly acid, caused by the presence of sulphur associated with more or less iron in solution.

PHYSIOGRAPHIC AND GEOLOGIC FEATURES OF THE DISTRICT.

This mound has an axis line running northeast and southwest 3,500 feet in length, crossed by a shorter axis of about 1,700 feet. The entire elevation embraces about 125 acres, whose more elevated portion is about 40 feet above sea level, and is generally known as "Spindle Top."

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[a] During the year there were two publications that gave a large amount of information regarding the occurrence and properties of the Texas petroleum. The first was Bulletin No. 184, United States Geological Survey, by Mr. George I. Adams, 1901, already mentioned, and the other was Bulletin No. 5 of the University of Texas, July, 1900, by Dr. William B. Phillips, director of the University of Texas Mineral Survey, with extracts from the report of Mr. Benjamin F. Hill, assistant geologist of the Survey.

Surrounding this slight elevation is a flat plain gently sloping toward the Gulf of Mexico, 18 miles distant southward. This plain is cut by many sluggish streams, containing large areas of salt marsh subject to overflow from the Gulf in time of storm. To the north, however, there is a gradual rise for from 12 to 15 miles, reaching a timber section of the long-leafed pine.

The geological age of the strata storing this wonderful deposit of petroleum is difficult to determine, partly owing to there being no exposures of strata, and to the mixing of the strata loosened by the drill with mud and slime. Generally the drill penetrates a series of loose sands, with beds of clay, containing, in rare instances, indications of lignite, with some fossils of the more recently formed strata; in fact, many of the fossil varieties are found living in the waters of the Gulf of Mexico at the present time. The condition favorable for the accumulation of petroleum as found at Spindle Top is one of special structure, which is confined so far as developed to it; many deep wells have prospected for it without success.

The main reservoir of petroleum is a deposit of nearly pure carbonate of lime, with more or less native sulphur associated with it. This is usually encountered at from 1,010 to 1,040 feet in depth. This deposit is from 25 to 75 feet in thickness. The temperature of the petroleum which it contains is between 80° and 83° F.

DEVELOPMENT OF THE INDUSTRY.

By the 1st day of July, 1901, there were 14 producing wells, all flowing oil from the same horizon, at 980 to 1,040 feet in depth, on Spindle Top proper, excepting one which was flowing from a shallower, higher pay streak. There were three abandoned holes. Two were abandoned because of the finding of a reservoir of natural gas under high pressure above the regular pay streak by nearly 150 feet, which suddenly developed its power, cleaning out the well by blowing out the water and the drilling pipes. One of them kept up its volcanic action for from six to eight hours. It blew out great volumes of sand, mud, gravel, and good-sized rocks, wrecking the top of the derrick and filling the derrick floor with several feet of quicksand, which sloughed off, and finally occupied a space 100 to 150 feet in diameter. After exhausting these pockets of gas, which must have contained the hydrocarbon compressed at not less than 250 pounds to the square inch, the flow entirely ceased, and the cavity at the bottom, filled by loose rock and bowlders, prevented further operations in these wells. There were also located on the elevation known as Spindle Top by July 1, 15 drilling wells and 18 rigs, making in all 52 operations. Inside of a circle of 3 miles in diameter, with the original Lucas well as a center, there were 96 rigs and 40 drilling wells, 13 dry holes, and 10 abandoned wells and 14 producing wells, making a total of 173 operations; outside of these there were 25 rigs, 8 drilling wells, and 5 dry holes, making 38 operations, and, all told, there were at the beginning of July, 211 operations in Jefferson County, Tex.

Of the 14 producers before mentioned on Spindle Top, 9 or 10 yielded from 10,000 to 70,000 barrels per day. The remainder were much smaller, ranging from 3,000 to 5,000 barrels per day. A number of the wells immediately surrounding this mound were drilled to a depth of 2,000 feet without encountering anything but a pink-colored sand alternating with clay. None of the streaks or deposits of carbonate of lime were found, and none of them developed more than a slight show of gas. About this time it began to be understood that Spindle Top, with its 120 to 125 acres, contained all the productive area that could be reached by wells of ordinary depth in this neighborhood. This caused a great rush for territory on the "hill," a considerable portion of which was divided up into small lots of one-eighth and one-sixteenth of an acre and sold to companies, many of which had been unfortunate in their location elsewhere.

By the close of the year there were 138 wells drilled in this section on Spindle Top, 55 of which were producers, belonging to companies that have marketed their oil, and 77 were not producers to any extent, owing to want of a market for their products. Several, however, were dry. Many of them were crowded so that almost the entire area was in localities occupied by derricks. The price paid for a single location was as much in some cases as $20,000, or at the rate of $150,000 per acre.

The rotary method of drilling has been used almost altogether in Texas, having been introduced many years previous in developing artesian water wells. Some of the improved rigs had provision for using the ordinary cable method temporarily, in case hard material should be encountered.

The rotary drill has many advantages in loose, caving strata, as the inside and outside of the casing or pipe carrying the cutting wings is full of water, which by its pressure sustains the walls of the well, and the muddy water in many cases forms a coating on the strata which assists in supporting the walls of the well. In loose strata the method is very rapid. However, a few feet of a solid layer, or a large bowlder, may take weeks of work to get past it. When no obstructions are encountered the work proceeds very fast, and 200 feet or better is often accomplished in a single day. The method has its objectionable features, because in a new country the column of water, by its weight, very often forces back the petroleum that may be reached, and thereby defeats the very object of the enterprise. Then, again, it is almost impossible to know when there is a change in the material, which renders the well record faulty. Stops can be made and the water bailed out to test the presence of petroleum or gas; but this is often risky operation, owing to the tendency of the walls of the well to cave. The wells in this region are usually started with 10-inch casing, followed by 8-inch, and it is aimed to finish with 8 or 6 inch casing. A few 8-inch holes have been completed, but the majority of them are finished with 6-inch casing, and a number are only 4 inches at the bottom of the well.

The depths of the wells to the productive bed vary from 880 feet, about the center of the elevation at Spindle Top, to 1,190 feet near the edges of the productive area, indicating that the stratum holding the petroleum is in a general way conical, which condition seems to be verified by the deep wells less than 500 feet from defined territory, failing to find any trace of the open cellular carbonate of lime and pure sulphur structure encountered on the mound at depths of from 2,000 to 2,500 feet.

The thickness of the oil-bearing formation is placed by different drillers at from 20 to 75 feet. It is almost pure carbonate of lime with more or less combined sulphur as well as surrounding crystals of pure sulphur.

The following analysis of the cap rock was made by Mr. S. H. Worrell, of the University of Texas mineral survey:

Analysis of cap rock at Beaumont, Tex.

	Per cent.
Lime	54.89
Carbonic acid	42.45
Sulphur, free and in organic combination	1.58
Sulphur as sulphuric acid in combination	.21
Silica	.40
Oxide of iron	.50
Oxide of aluminum	.50
Magnesia	Trace.

There is no doubt that many of the samples carried out with the first rush of petroleum from many of the gushers contain a much larger proportion of free sulphur embedded in the carbonate of lime than is shown in the above analysis.

There are instances where the loose sand immediately above the pay streak or cap rock contains pieces of pure sulphur as large as hazel nuts.

LOG OF LUCAS WELL.

The following is a corrected record or log of the original Lucas well, furnished by the Beaumont Engineering Company, and it varies somewhat from the log formerly published in the report of 1900, which is said to contain some slight typographical errors. There is some uncertainty as to the exact depth at which the large flow was found. However, by comparison with the wells afterwards drilled near by the depth is placed at between 1,029 and 1,069 feet.

Log of the Lucas well, near Beaumont, Tex.

Formation.	From—	To—	Thickness.
	Feet.	*Feet.*	*Feet.*
Yellow clay	0	36	36
Coarse gray sand	36	56	20
Blue clay, pretty hard	56	170	114
Fine gray sand	170	245	75
Variously colored gravel, from bean to goose-egg size	245	265	20
Coarse gray sand	265	317	52
Blue clay	317	352	35
Coarse gray sand, with pyrite concretions	352	376	24
Blue clay	376	395	19
Fine gray sand, with lignite	395	440	45
Marl	440	448	8
Gray sand, with concretions and much lignite	448	508	60
Soft limestone	508	508.75	0.75
Gray clay and sulphuretted hydrogen gas	508.75	528.25	19.50
Hard sandstone, with calcite depositions	528.25	529	0.75
Gray sand	529	563	34
Compact hard sand, with pyrite	563	588	25
Hard sandstone and calcareous concretions	588	588.5	0.5
Gray clay	588.5	601.75	13.25
Hard sand	601.75	602	0.25
Gray clay, with calcareous concretions	602	659	57
White calcareous shells	659	665	6
Gray clay	665	679	14
Gray sandstone, with oil	679	685	6
Gray clay, with calcareous concretions	685	692	7
Gray clay, getting harder	692	715	23
Calcareous concretions, with calcite	715	717	2
Hard gray clay, with calcareous concretions; much fine pyrite	717	833	116
Do	833	853	20
Sandstone and pyrite; hard	853	873	20
Hard rock; apparently limestone	873	875	2
Fine oil sand, with large layer toward bottom and heavy pressure under it, filling casing for 100 feet above point of drilling	875	899	24
Hard clay	899	979	80
Calcareous concretions, with layers of hard sandstone	979	1,029	50
Struck heavy gas pressure and oil, which lasted about one hour and then subsided	1,029	1,069	40
Sand mixed with calcareous concretions and fossils	1,069	1,139	70

LOG OF HIGGINS WELL NO. 1.

The following record is one that was most carefully kept by Mr. Higgins, of Beaumont, and is of one of the best of the early gushers on Spindle Top. This well was finished with 4-inch tubing and was remarkably vigorous:

Log of the Higgins Well No. 1, Beaumont.

[Three feet of black loam at surface.]

Formation.	From—	To—	Thickness.
	Feet.	*Feet.*	*Feet.*
Blue clay	3	30	27
Quicksand and very fine sand	30	51	21
Fine sand mixed with clay	51	80	29
Fine sand mixed with very fine clay	80	100	20
Sand as fine as flour	100	110	10
Fine sand	110	120	10
Clay, sand, and stone	120	140	20
Fine sand and brackish water	140	160	20
Blue clay	160	170	10
Coarse sand	170	180	10
Coarser sand	180	200	20
Medium fine sand	200	225	25
A little finer sand	225	245	20
Coarser sand, with black pebbles	245	260	15
Still coarser sand	260	280	20
Coarse sand mixed with clay	280	360	80
Coarse sand, no clay	360	365	5
Coarser sand	365	380	15
Very coarse sand	380	395	15
Coarse sand, with black pebbles and shells	395	418	23
Sharp, finer sand and shells	418	425	7
Blue sand, still finer	425	445	20
Coarse sand	445	460	15
Sharp sand, coarse shells	460	490	30
Sharp sand, coarser shells	490	515	25
First sign of oil	515	536	21
No oil; coarse sand and shells	536	556	20
Coarse sand with black pebbles. Struck more oil than at 536	556	575	19
Very fine blue sand; no oil	575	595	20
Coarser sand, some shells	595	615	20
Coarser sand and siliceous pebbles	615	700	85
Very coarse blue shells	700	785	85
Finer shells; some blue clay	785	805	20
Clayey sand; numerous shells	805	825	20
Sand; some shells	825	845	20
Blue sand; some shells	845	875	30
Little finer sand; some shells	875	900	25
Yellow sand; fairly good signs of oil, which settled on water	900	920	20
No oil; medium fine sand	920	940	20
Blue shale; some shells	940	945	5
Blue shale; no shells	945	960	15
Darker sand, with trace of oil	960	980	20
Lighter colored sand; blue shale; trace of oil	980	1,000	20
Blue shale; trace of oil, and a barrel of oil baled in 2 days	1,000	1,020	20
Oil-bearing rock	1,020	1,030	10
Sulphur and rock	1,030	1,040	10

MARKETS FOR BEAUMONT PETROLEUM.

The Spindle Top or Beaumont petroleum is gradually finding more extended markets as the quantity and quality have been more fully demonstrated. The large consumers of coal in the Southwest and West are the railroads, and by reason of the long haul and of the inferior quality of the Southwestern coal this fuel is particularly acceptable to them. They will soon have arrangements to meet the California fuel petroleum near the Pacific, and thus have a continuous line of locomotives burning liquid fuel from New Orleans to San Francisco. Many tank cars have been supplied by the railroads and purchased by the petroleum producing companies that are gradually widening the circle of distribution. There are many industries in this portion of the South that now consume the petroleum for fuel, and its cheapness will soon invite others to the locality.

In time this fuel must find a wider range of distribution by the cheaper water route to New Orleans. From there it will be distributed to the lower Mississippi River region by barges.

The Atlantic coast cities as far north as New York must in time consume a portion of this fuel as well as the products of distillation used in the manufacture and enrichment of illuminating gas. Several cargoes have already been exported to Europe.

The marketing and storing of over 5,000,000 barrels of petroleum produced in the Beaumont fields in ten days less than one year is a remarkable record. It must be remembered that tank cars and tank ships, with the necessary receiving tanks, can not be built in a month. In time, however, if the production keeps up, the amount distributed by water will greatly exceed that of the railroad. During the past year, 85 per cent of the shipments were by rail and only 15 per cent by tide water.

PHYSICAL PROPERTIES OF BEAUMONT PETROLEUM.

The physical properties of the Spindle Top petroleum have been determined by Prof. Boverton Redwood, of London, England, to be as follows:

Specific gravity at 60° F., equal to 15.5 C.	0.922, or 21.97° Baumé
Flash point (close test)	170° F., or 76.7° C.
Viscosity, by Redwood's standard	188 seconds (for rape oil = 100)
Viscometer at 70° F.	50 c. c. = 33.3 at 60° F.
Cold test	Fluid at 0° F.
Carbonaceous residue on distillation to dryness	4.40 per cent
Sulphur	1.33 per cent
Calorific value (1 pound to degree C.)	10.771 calories
Calorific value (1 pound to degree F.)	19388 B. T. U.

The following is also a physical and chemical analysis of Spindle Top petroleum sampled from barrels as they were used in a test under the directon of Prof. James E. Denton, made at New York in December, 1901, for the Export Oil and Pipe Line Company, Beaumont, Tex.:

Specific gravity	0.92, or 22.02° Baumé
Flash point	142° F.
Boiling point	181° F.
Cold test	−6° F.
Calorific value, per pound, by oxygen calorimeter	19060 B. T. U.

The following table gives the ultimate composition of Beaumont, Pennsylvania, Lima (Ohio), and Russian petroleum as determined by the authorities named:

Composition of Beaumont, Pennsylvania, Lima (Ohio), and Russian petroleum.

[Per cent.]

Elements.	Beaumont.[a]	Beaumont.[b]	Pennsylvania.[c]	Lima, Ohio.[d]	Russia.[e]
Carbon	84.60	85.03	86.10	85.00	86.60
Hydrogen	10.90	12.30	13.90	13.80	12.30
Sulphur	1.63	1.75	0.06	0.60	0.00
Oxygen and nitrogen	2.87	0.00	0.00	0.60	1.10
Loss in treatment with excess of H_2SO_4	....	39.0	21.0	30.0	....

[a] Denton. [b] Richardson and Wallace. [c] Engler. [d] Mabery and Noble. [e] Redwood.

Some of the analyses of Beaumont petroleum put the sulphur as high as 2 per cent and over.

In the former tables the ultimate calorific value of Beaumont petroleum as determined by Redwood and Denton is remarkably similar, the mean of the two being 19.224 B. T. U. The calorific value of Pennsylvania and Ohio crude petroleum approximates 20.200 B. T. U.; that of Baku, Russia, crude is about 19.500. The value of liquid fuel when sold by measure is remarkably regular for most of the large productive fields of the world.

In the actual evaporative test Professor Denton demonstrated that out of the ultimate 19.060 B. T. U. that are contained in one pound of Beaumont petroleum 14.587, or 78.5 per cent of the entire value, was made effective in practice, in boilers well proportioned and carefully handled, equal to 14.8 pounds of water to 1 pound of petroleum. In ordinary practice 13 pounds of water should be evaporated by 1 pound of Beaumont petroleum, as compared with 6 to 6.5 pounds of water evaporated by the bituminous coal from Indian Territory and New Mexico.

The ratio of evaporation is found by considering the pounds of petroleum as the measure of the coal. In this case they are as 1 to 2 ($\frac{13.0}{6.5}=2$). The ratio is therefore 2. If a better grade of coal be used more barrels of petroleum will have to be used to do the same work. One pound of ordinary Pittsburg coal under fair conditions will evaporate 8.7 pounds of water at 212° into steam. To equal this 13 pounds of petroleum are required. The ratio would therefore be 1.5 ($\frac{13}{8.7}=1.5$). Beaumont petroleum of 22° Baumé, or .921 specific gravity, weighs 7.68 pounds to the gallon, or 322 pounds to the barrel. In the first case the ratio is as 1 to 2, or 2, or 1,000 pounds of petroleum will equal 2,000 pounds of coal. Now 1,000 pounds of petroleum are equal to 3.1 barrels ($\frac{1000}{322}=3.1$), so in the other case 1,333 pounds of petroleum will equal 2,000 pounds of coal, or 4.14 barrels ($\frac{1333}{322}=4.14$) will equal 1 ton of 2,000 pounds of coal.

The prices named in the following table are consistent with good practice with ordinary boilers. The conditions under which coal and petroleum are usually burned are considerably in favor of the petroleum, approaching more closely the theoretical equivalent than where coal is used. There is also a deduction of 10 per cent allowable under most conditions, owing to the economy in labor in handling the petroleum as compared to the cost of coal, besides the benefits of cleanliness and healthfulness.

COMPARATIVE FUEL VALUE OF COAL AND BEAUMONT PETROLEUM.

One pound of southwestern coal will, under fair conditions, evaporate 6.5 pounds of water at 212° F. One pound of Pittsburg coal of fair quality will evaporate 8.7 pounds of water under like conditions. One pound of Beaumont petroleum will evaporate 13 pounds of water under like conditions.

Comparative fuel value of coal and Beaumont petroleum.

Price of Southwestern coal per ton of 2,000 pounds.	Number of barrels of Beaumont petroleum to equal 1 ton of coal.	Price of Beaumont petroleum per barrel to equal cost of 1 ton of Southwestern coal.	Price of ordinary Pittsburg coal per ton of 2,000 pounds.	Number of barrels of Beaumont petroleum to equal 1 ton of Pittsburg coal.	Price of Beaumont petroleum per barrel to equal cost of 1 ton of Pittsburg coal.
$1.00	3.1	$0.32	$1.00	4.31	$0.23
1.25	3.1	.40	1.25	4.31	.30
1.50	3.1	.49	1.50	4.31	.35
1.75	3.1	.57	1.75	4.31	.41
2.00	3.1	.65	2.00	4.31	.47
2.50	3.1	.80	2.50	4.31	.58
3.00	3.1	.97	3.00	4.31	.70
3.50	3.1	1.13	3.50	4.31	.83
4.00	3.1	1.29	4.00	4.31	.93
4.50	3.1	1.45	4.50	4.31	1.05
5.00	3.1	1.61	5.00	4.31	1.16
6.00	3.1	1.94	6.00	4.31	1.39
7.00	3.1	2.22	7.00	4.31	1.62

Petroleum is an ideal fuel on the locomotive because of its quick response to a sudden demand and because the heat can be as quickly cut off when the demand ceases. In the narrow limits of a locomotive fire box, where properly consumed, the combustion is more complete than in the case of coal, thereby adding as much as 30 per cent to the efficiency of the boiler. It weighs only 67 per cent as much as coal for the same heating effect. It is free from the disagreeable and dangerous effect of sparks, smoke, and cinders. It passes into the fire box by gravity, there to be atomized by steam or compressed air, thereby saving the exhaustive labor of the fireman.

Full and complete tests showing the actual work accomplished by any given amount of Beaumont petroleum in the locomotive boiler in service are not at hand. However, it is safe to say that with ordinary handling, 2½ pounds of petroleum will do the work of 4 pounds of McAlester or Comax coal. Multiplying both these quantities by 500, we find that 1,250 pounds petroleum, or 3.12 barrels are equal to 2,000 pounds of coal. If the cost of the coal was $3.12 per ton, the cost of a barrel of petroleum would be $\frac{\$3.12}{3.12} = \$1$ per barrel.

The fire boxes of locomotives which use petroleum for fuel must be arched with fire brick above where the spray strikes the back of the box, which must also be protected by fire brick, and an inverted arch of the same material should extend down into the ash pan, with open spaces in the brickwork and an open space at the front end for the admission of the air.

The danger from fire from crude petroleum from the Beaumont field is not so great as is usually supposed. However, it is always best to take all possible precautions in handling liquid fuel, especially on shipboard or near large accumulations of it. The following experiments were made by Prof. James E. Denton, of the Stevens Institute of Technology, Hoboken, N. J.:

A pool of oil spilled upon a board can not be ignited by a match. The latter extinguishes itself when the match is partly burned. The instant the match comes in contact with the oil, air is excluded from its lower surface so that the flame is above the oil, and it can not therefore vaporize sufficient of the latter to bring vapor into contact with the flame of the match and ignite.

A splinter of dry wood, about one-fourth of an inch square and 6 inches long, ignited at one end, will not ignite oil in a shallow dish, but when this splinter is smeared with oil the latter burns rapidly over the length of the splinter after the end of the latter is ignited to a blaze by a match. The flame at the end of the splinter vaporizes the film of oil near it, so that the vapor floats into contact with the flame and ignites. This vapor in burning vaporizes, and ignites the film farther along the splinter, until the oil over the whole length of the latter is aflame.

The principle governing ignition of a mass of oil below a body of air is that the oil must be vaporized and the vapor come into contact with a temperature above a red heat.

For example, a pan 10 by 14 inches filled with oil to a depth of about an inch, had a handful of blazing waste.

At temperatures of oil from the flashing point, 142° to 200° F., vapor was visible as it escaped through the half-inch hole in the cover, which ignited with a match, and burned so as to form a feeble flame. This flame could not be blown inside of the cover, nor would a lighted match dropped through the cover affect the contents of the jar.

These results showed that above 142° F. the oil vaporized sufficiently to drive out the air from the jar and fill the latter with vapor, which could not burn within the jar, as no air was present to support combustion; but on issuing from the jar and mixing with air the vapor could burn.

With the cover removed the application of the flame of a match to the vapor floating out of the jar would not ignite it at 1 inch or more above the outlet, but applied at the outlet the contents of the jar above the oil ignited, and burned with a sluggish flame for about a second, when combustion ceased. The upward current of vapor was then reestablished, and the ignition could then be repeated.

These results showed that the vapor in floating about an inch from the jar so diluted itself with air that it was noninflammable, but closer to the jar it formed a burning mixture with the air, and being ignited at this point sufficient air found its way into the wide mouth of the jar to enable the contents of the latter to inflame. Then the upward current due to heat excluded the entrance of air, and combustion ceased, after which the upward vapor currents reestablished themselves.

The experiments with the vapor of the oil show that its volatility does not give rise to inflammable vapor until it is heated above 142° F. Then as the vapor is essentially identical with that given off by gasoline at ordinary temperatures, all the well known safety precautions for the storage and handling of the latter substance apply to the oil, although the rapidity with which vapor is given off per square foot of surface is much less with the oil than with gasoline.

It was suggested during the evaporative tests that the accidental opening of the oil valve of the burner, so as to cause a large excess of oil in proportion to the steam-jet supply, was a source of danger, as it would cause some sort of explosion in the furnace.

The maximum draft of the chimney supplied only air enough for the perfect combustion of as much oil as corresponded to about one-half of the full opening of the oil valve. The oil valve of one burner was suddenly changed from this setting to wide open twice on the last day of the use of oil, and the only effect was to fill the furnace with thick smoke, no explosion or excess of pressure in the furnace occurring. The following experiment also affords similar conditions:

A red-hot rod of iron was inserted through a half-inch hole in the cover of a glass fruit jar half full of oil, so that about 1 inch of red-hot iron was submerged in the oil, leaving two red-hot inches out of the oil. The jar was instantly filled with a dense white vapor, which ignited, burned for a second, and then extinguished itself on account of the deficiency of air. There was no explosion or excessive increase of pressure.

The comparatively large amount of sulphur, ranging from 1.5 to 2 per cent, in the Beaumont petroleum has been a source of some speculation as to its effect on the plates and flues of the boilers using this petroleum. The results, however, in many tests have shown that the iron or steel flues and plates were not more seriously affected than by the ordinary coal fuel. Sulphur, existing in a free state, or as sulphuretted hydrogen in the combustion chamber, has both hydrogen and oxygen presented to it, with which it will unite in preference and will not act corrosively on the metal of the boiler. It is besides greatly adulterated by the volume of nitrogen, oxygen, and hydrogen. In many of the best grades of bituminous coal the sulphur varies from 1 per cent in the best to 3½ per cent. Even coal containing as much as 4 to 5 per cent of sulphur is used by many railroads without injury to the boiler proper, however much the grate bars may suffer.

The first steamer to cross the Atlantic with petroleum fuel reached Philadelphia December 18, 1901. She was the British tank steamer *Calm*, belonging to Samuels & Co., of London, and was commanded by Captain Evans.

Investigations made in the laboratory of the University of Texas mineral survey by Mr. O. H. Palm and Mr. S. H. Worrel gave the following calorific results of Texas petroleum:

Heating value of some Texas petroleums.

[In B. T. H. and calories.]

	British thermal units.	Calories.
Original Lucas well, Jefferson County	19,574	10,874
Higgins Oil and Fuel Co., Jefferson County	19,785	10,992
Sour Lake, Harden County	18,694	10,305
Walsh Tract, Bexar County	16,518	9,177
Near Dunlay, Medina County	16,807	9,372

DERIVATIVES FROM BEAUMONT PETROLEUM.

From the general results secured by the chemists and refiners who have analyzed this crude Beaumont petroleum the predominating opinion is that, though it is eminently fitted for a fuel, the present known methods have failed so far to secure enough illuminating and lubricating petroleum to justify its being refined commercially.

Of the first products, according to Prof. C. F. Mabery, from 145° to 200° F. only 4 per cent passed over at 46° Baumé, or 0.7954 specific gravity; from 200° to 250° F. only 11 per cent passed over at 35° Baumé, or 0.8484 specific gravity, which is much heavier than the ordinary illuminating petroleum marketed in the United States, about 0.800 to 0.810 being the usual specific gravity of the latter.

The quality of the lubricating derivatives has not as yet been publicly demonstrated.

There were three refineries under construction at Port Arthur at the close of 1901, which claim a larger percentage of illuminating petroleum as well as marketable lubricating products secured from Beaumont petroleum. It is necessary to take out a portion of the more volatile products, so that the oil will stand the fire test required in European markets. The lighter products are marketed abroad as gas oil.

INVESTMENTS AT BEAUMONT DURING 1901.

Some idea of the amount of money that has been invested in the section surrounding Spindle Top, near Beaumont, from the beginning of the development in January to the close of 1901, is furnished by the items collected by Mr. L. C. Sands, of the Oil Well Supply Company.

These items are given under general headings; the details, while interesting, would occupy too much space:

Capital invested in the Beaumont oil district.

Producing wells, 138, at $7,429 each	$1,025,202
Drilling wells, 46, at $4,000 each	184,000
Abandoned wells and dry holes, 28, at $15,611 each	437,108
Iron tanks completed, 2,825,800 barrels, cost 25 cents per barrel	706,450
Wooden tanks completed, 33,150 barrels, cost 37½ cents per barrel	12,425
Iron tanks building, 904,500 barrels, cost 12½ cents per barrel	112,000
Earthen reservoirs, 190,000 barrels, cost 7.2 cents per barrel	13,750
Pumping stations, 10 stations, average $7,770 each	77,700
Pipe lines, 125 miles of pipe from 10 to 4 inches, and laying same	550,200
Loading racks, to stand 161 cars, at $82.30 each	13,250
Tank cars, 325 purchased by oil companies, at $800 each	260,000
Refineries, 3 in process of erection at Port Arthur	265,000
Rotary drilling outfits, 84, estimated cost $3,500 each	294,000
Total amount invested	3,951,085

WELLS PRODUCING AND SELLING PETROLEUM AT BEAUMONT IN 1901.

The number of wells from which petroleum was sold at Beaumont in 1901 and the companies represented are as follows:

Number of wells in the Beaumont oil district in 1901.

Alamo Oil Co	1
Buffalo Oil Co	2
Drillers' Oil Co	
Ballinger Oil Co	1
Drummers' Oil Co	
Cartwright Oil and Development Co	1
Citizens' Consolidated Oil Co	1
Cronin Land and Oil Co	1
Columbia Oil Co	1
Cincinnati-Beaumont Oil Co	2
Cattlemen's Consolidated Oil Co	1
Detroit-Beaumont Oil Co	1
Home Oil Co	
Enterprise Oil Co	1
Gladys Oil Co., of Galveston	
Lucky Dime Oil Co	
Victor Oil Co	
Fountain Oil and Fuel Co	1
Gladys Oil Co., Beaumont	1
Ground Floor Oil Co	1
J. M. Guffey Petroleum Co	12
Geyser Oil Co	1
Georgetown-Waco Oil Co	1
Higgins Oil and Fuel Co	3
Heywood Oil Co	3
Huntley Oil and Refining Co	1
Houston-Beaumont Oil Co	1
Ira O. Wyse Oil Co	1
King Oil Co., El Paso	1
Mitchell Oil Co	1
Merchants and Mechanics' Oil Co	
Spangler Oil Co	1
Mississippi-Texas Oil Co	1
National Oil and Pipe Line Co	3
Palestine-Beaumont Oil Co	1
Queen of Waco Oil Co	1
Twentieth Century Oil Co	1
Bayou City Oil Co	
Yellow Pine Oil Co	2
Manhattan Oil Co	2
Kieth-Ward Oil Co	2
	55

PRODUCTION IN BEAUMONT DISTRICT IN 1901.

The statistics of the production of petroleum in the Beaumont oil district in 1901 are as follows:

Production of petroleum in the Beaumont district in 1901.

Total quantity of crude petroleum produced and sold (barrels)	3, 593, 113
Total value received for this petroleum at wells	$630, 753
Average value received per barrel	$0. 175
Stock on hand December 31, 1901 (barrels)	1, 592, 770
Total number of companies which produced this petroleum	41
Total number of wells owned by these 41 companies	55
Total number of producing wells not operated in 1901	83
Total number of productive wells in the field December 31, 1901	138

From the above statement we are enabled to make the following table of production in the Beaumont district in 1901:

Production of petroleum at Beaumont in 1901.

	Barrels.	Value.	Price.
Produced and sold	3, 593, 113	$630, 753	$0. 175
Stock on hand December 31, 1901	1, 592, 770	318, 554	. 20
Total	5, 185, 883	949, 307	. 183

In addition to this amount a large quantity of crude oil was consumed by a conflagration and wasted, for which no reliable figures can be given. It has been estimated that not less than 1,000,000 barrels were produced and unaccounted for, so that the total gross production was estimated to have been 7,000,000 barrels, including the production of the Corsicana and all other districts during the year 1901.

PROBABLE FUTURE OF THE DISTRICT.

There are possibilities that deeper drilling may develop other pay streaks at Spindle Top. Indications seem to show that the output of the present pay rock on the 125 acres developed will soon be decreased to a point where the wells will cease to flow when 15,000,000 to 18,000,000 barrels have been taken out. The dregs will have to be secured by the more tedious method of bailing or pumping.

However, there are other sections on these great level plains where strong indications of dormant gushers exist. In all reasonable probability there are other localities that are capable of producing wells of large production. It is probable that this section bordering on the Gulf will have its periods of depression following its present prosperity, which in turn will be followed by the legitimate business of the production of petroleum. The final result seems to be assured that Texas will in the course of time be at the head of the list of the oil-producing States in this country.

SOUR LAKE FIELD, HARDIN COUNTY.

This is another locality that is producing petroleum in the State of Texas. It is about 20 miles northwest of Beaumont. The earliest visitors to this region reported more or less petroleum associated with natural gas in the locality of the lake, which takes its name from the acid waters found in it, caused by the oxidation of the sulphur brought up by the springs in the bed of the lake. A number of shallow wells, probably five in all, were drilled in this locality previous to 1901. The earliest development dates back to 1893. Three of them found a small amount of heavy petroleum of 16° gravity in a loose sand at about 230 feet. During the summer of 1901 the J. M. Guffey Company drilled a well in this locality that gave spasmodic flows of loose sand and mud accompanied with considerable petroleum and some gas at a depth of about 900 feet. Several pockets of gas were found that gave temporary flows in this manner, completely filling the casing for 700 feet or more. It was finished at 1,200 feet. In November a well was completed to a depth of 1,500 feet for the Great Western Oil Company, by Mr. Neil Sinclair, contractor, which encountered more or less loose sand alternating with clay and beds of gravel. Between 850 and 880 feet a sand was encountered which gave a big flow of hot salt water impregnated with sulphur; the water was at a temperature of 100° and was accompanied with some petroleum. At 1,040 feet four distinct petroleum sands were encountered, each about 10 feet thick and separated by a hard crystalline sand. The lowest of these sands contained some petroleum, followed by another flow of hot salt water over 100° in temperature. Then followed shale with bowlders and some petroleum at 1,080 to 1,090 feet. From 1,090 to 1,400 feet there were hard and soft sands, the upper portion being very fine, and finally the last 100 feet was a series of beds of iron pyrites 5 to 10 feet in thickness, separated by beds of clay. None of these measures contained any signs of petroleum.

About the middle of March, 1902, the Great Western Oil Company secured a gusher at a depth of 683 feet, located near the original wells about 400 yards north of the hotel building at Sour Lake. After penetrating 40 feet of very nice oil sand, upon which the 8-inch casing rested, the 6-inch casing was pulled back and the well began to flow vigorously.

Three times after it was cleared it flowed a solid 8-inch stream 25 feet above the top of the derrick. This well is like the first one, except that it has much more vigorous, spasmodic flows, accompanied with loose sand, which interrupts the flow of the petroleum and renders it difficult to keep the bore hole unobstructed. This sand has to be bailed out, and the valve closed for a time; then when the valve is suddenly opened the well will flow furiously. In these peculiar features its action is very similar to that of the Baku wells in Russia. This petroleum is said to be lighter than that at Beaumont.

Twelve miles west of Sour Lake a well at Saratoga has produced considerable petroleum from a depth of 980 feet. It was drilled in the fall of 1901, and its production is variously estimated at from 25 to 100 barrels per day. It was reported that 2,000 barrels of petroleum were in stock at Saratoga and Sour Lake at the close of the year.

OTHER TEXAS OIL EXPERIMENTS.

Bastrop County.—There are some wells in this county which will produce a small amount of oil, but they are of no commercial value.

Bexar County.—Four wells have been completed in this county, all of which will produce from 2 to 5 barrels of oil per day. The wells are not over 600 feet in depth, and produce a heavy lubricating oil, which is secured by pumping. Only a small amount of oil was produced and sold in 1901.

Brazoria County.—The Bryan Heights oil field is now in course of development. Some wells have been drilling near Valasco, which will produce a limited amount of oil. These wells have not been completed. The drill has passed through several oil strata, but oil in paying quantities has not been found. One well has also been drilled near Alvin.

Caldwell County.—At the close of 1901 one well had been commenced near Lockhart. At a depth of 160 feet a stratum of oil was struck that will produce 6 to 8 barrels of oil daily. It is the intention of the company to go down 2,500 or 3,000 feet, unless oil in paying quantities is found higher. So far as learned no other operators are in this field.

Concho County.—In drilling for water oil was found in two wells about 6 miles from Paint Rock. The wells are very shallow, one being 60 feet, the other 25 feet; they are 120 feet apart. The land has been leased, and further investigations will be made. The oil was found in a soft blue rock.

El Paso County.—Several companies have commenced work in this county. There are indications of a fine blue oil in a well near El Paso. As yet no petroleum has been produced.

Robertson County.—One well was bored near Hearne, but at a depth of 1,300 feet it was abandoned. At 850 feet gas was struck. Two wells put down in the northeastern part of the county proved to be dry. There was one well near Bremond in process of drilling. It had reached a depth of 800 feet September 25, 1901, but on account of scarcity of water (there being no rain for six months) work was suspended. At the depth of 800 feet a high grade of oil was found.

Young County.—One well is drilling near Graham. The drill has reached a depth of 620 feet, but it is not expected that oil will be found until the well is 1,000 or 1,200 feet deep. Experts who have examined the formations passed through give a very flattering report. About 9 miles west of Graham two wells have been completed which will produce a very fine grade of lubricating oil. None of the oil has been sold.

McMullen County.—Three wells have been drilled to oil sand in the northeastern part of this county. No oil has been marketed, but it is reported to be a high-grade illuminating and lubricating oil.

Medina County.—So far as learned one well has been completed in this county which will produce oil. The product is found at a depth of 162 feet. It is a fine lubricant in its natural state, and a good fuel oil. It shows 52 per cent pure liquid asphalt, 25 per cent illuminants, and the remainder lubricants. None of the oil has been marketed.

Galveston County.—One company has commenced boring at High Island, and two other companies are preparing for work. Three rigs have been completed. No petroleum has as yet been produced in this county.

Gonzales County.—Many wells in this county show the existence of petroleum. A number of wells dug for farm use contained so much oil that they were unfit for drinking purposes. It is reported that many leases have been taken with a view to sinking wells at some future time. There are no producing wells in the county.

Nacogdoches County.—There are about 25 wells in this county, but they were not operated in 1901, the supply of oil not being adequate to the expense of operating them. The wells would probably produce from 1 to 5 barrels per day.

Polk County.—There are no producing wells in this county. A well is being sunk about 2 miles from Livingston, but oil has not been struck at this time.

Reeves County.—Several wells have been drilled in this county and several are now being drilled (January, 1902), but as yet there are no petroleum producers.

Corsicana field.—This is the field that first brought the State of Texas into the list of producers in 1896. There are now two grades of petroleum produced in this section. During 1900 a new field of heavy petroleum was discovered 3 miles east of the original pool which surrounds the city of Corsicana on its eastern half, extending to the northeast. The depth of the wells in the main pool is from 1,010 to 1,050 feet; in the Powell pool the wells average 700 feet in depth. The remarkable purity of the petroleum produced in this field and the large percentage of merchantable products derived from it place it close to the value of the Lima (Ohio) petroleum.

The following analysis is given of Corsicana crude petroleum of 0.8206 specific gravity, by Mr. F. C. Thiele, in the Oil, Paint, and Drug Reporter:

Analysis of Corsicana petroleum.

	Per cent.	Specific gravity.
Naphtha	10.8	0.710
Kerosene (illuminating product principally)	54.5	.796
Residuum	34.7	.905

Mr. E. H. Earnshaw made a more elaborate analysis of the Corsicana oil with the following results:

Analysis of petroleum from Corsicana, Tex.

Fractions.	Temperature, degrees F.	Per cent. By volume.	Per cent. By weight.	Specific gravity at 60° F.
Colorless:				
A	130–200	2.80	2.24	0.6653
B	200–250	5.10	4.31	.7017
C	250–300	7.60	6.69	.7302
D	300–350	8.20	7.44	.7527
E	350–400	9.40	8.75	.7718
F	400–450	7.40	7.07	.7920
G	450–500	8.30	8.09	.8088
Very faint yellow:				
H	500–550	6.45	6.43	.8260
I	550–600	7.75	7.85	.8404
Yellow, J	600–650	14.95	15.43	.8555
Deep reddish yellow, K	650–665	17.25	18.07	.8687
Deep red (solid), L, over	650	1.30	1.41	.8972
Dark red-brown (solid), M, over	650	1.40	1.63	.9699
Residue	....	....	2.63	....
Total	....	97.90	98.04	....

PRODUCTION OF PETROLEUM IN TEXAS.

The production of petroleum in Texas since 1889 has been as follows:

Production of petroleum in Texas from 1889 to 1901, inclusive.

Year.	Quantity.	Year.	Quantity.
	Barrels.		*Barrels.*
1889	48	1897	65,975
1890	54	1898	546,070
1891	54	1899	669,013
1892	45	1900	836,039
1893	50	1901	4,393,658
1894	60	Total	6,512,566
1895	50		
1896	1,450		

The production in 1901, compared with 1900, shows a gain of 3,557,619 barrels, or 425.5 per cent. The value, however, increased only $375,355, or 43 per cent, over that of 1900.

CALIFORNIA.

The production of California in 1901 was 8,786,320 barrels, as compared with 4,324,484 barrels in 1900.

The State made a remarkable increase in its output of crude petroleum in the past year, a very large percentage of which came from the recently developed pools in Kern County.

The petroleum produced in this county, as well as a great proportion of that produced in the other counties in southern California, is eminently a fuel petroleum. As such, it is particularly acceptable, owing to there being no readily accessible deposits of coal of commercial value in the State or in the near-by States.

The cheapness of fuel has a direct bearing on the commercial supremacy of every State or country, as it is the direct source of light, heat, and power. The importation of coal from British Columbia, Australia, England, Wales, and Japan, and from the State of Washington into California, amounting to near 2,000,000 tons annually, at an outlay of not less than $12,000,000, must greatly decrease in the future. Especially does this seem true as the facilities for delivery of the petroleum by the pipe line now under construction from the Kern field to near San Francisco, will place this valuable liquid fuel at tide water with a guaranteed supply at such prices as will enable this locality to become a manufacturing center.

The railroads of this State have been particularly benefited by the use of this liquid fuel in their locomotives, for which it is admirably adapted, and are at present the largest consumers.

Tests have proved that 1 pound of California petroleum used on a passenger locomotive evaporated 10.96 pounds of water from and at 212° F., as compared with 7.14 pounds of water under like conditions evaporated by 1 pound of Comax bituminous coal, or 4 barrels of oil did the work of 1 ton of coal. This is rather below the results attained by other tests, which in many cases showed that from 3¼ to 3½ barrels of petroleum did the work of 1 ton of coal.

FOREIGN COUNTRIES OF THE WESTERN CONTINENT.

CANADA.

The following is a statement of the production of crude petroleum in Canada in the years 1898 to 1901, inclusive, by districts:

Production of crude petroleum in Canada from 1898 to 1901, inclusive, by districts.

[Barrels of 35 imperial gallons, or about 42 standard gallons.]

District.	1898.	1899.	1900.	1901.
Petrolia	513,179	[a] 528,641	541,435	573,271
Oil Springs	133,366	[b] 107,487	99,019	76,059
Bothwell	66,401	65,044	47,405	44,954
Plympton	25,000			
Dawn	5,923			
Euphemia	5,227			
Zone	901			
Dutton		3,622	4,791	10,588
Total	750,000	704,794	692,650	704,872

[a] Includes production from Plympton.

[b] Includes the production from Dawn, Euphemia, and Zone.

The regularity of the production, as well as of the value for the last six years, as shown in the following table, is remarkable. The increased value for the last two years has rather more than offset the decline in production.

Canadian oils and naphtha inspected and corresponding quantities of crude oil, from 1881 to 1901, inclusive.

Year.	Refined oils inspected.	Crude equivalent calculated.	Ratio of crude to refined.	Production of crude petroleum.	Average price per barrel of crude.	Value of crude oil.
	Imperial gallons.	*Imperial gallons.*		*Barrels.*		
1881	6,457,270	12,914,540	100 : 50	368,987		
1882	6,135,782	13,635,071	100 : 45	389,573		
1883	7,447,648	16,550,328	100 : 45	472,867		
1884	7,993,995	19,984,987	100 : 40	571,000		
1885	8,225,882	20,564,705	100 : 40	587,563	$0.82¼	$483,271
1886	7,768,006	20,442,121	100 : 38	584,061	.90	525,655
1887	9,492,588	24,980,494	100 : 38	713,728	.78	556,708
1888	9,246,176	24,332,042	100 : 38	695,201	1.02⅔	713,740
1889	9,472,476	24,664,144	100 : 38	704,690	.92¾	653,600
1890	10,174,894	26,776,037	100 : 38	765,030	1.18	902,735
1891	10,065,463	26,435,430	100 : 38	755,298	1.33¾	1,010,211
1892	10,370,707	27,291,334	100 : 38	779,752	1.26¼	984,438
1893	10,618,804	27,944,221	100 : 38	798,406	1.09½	874,255
1894	11,027,082	29,018,637	100 : 38	829,104	1.00¾	835,322
1895	10,674,232	25,414,838	100 : 42	726,138	1.49⅔	1,086,787
1896	10,684,284	25,438,771	100 : 42	726,822	1.59	1,155,647
1897	10,434,878	24,844,995	100 : 42	709,857	1.42½	1,011,546
1898	11,148,348	26,543,685	100 : 42	758,391	1.40	1,061,747
1899	11,927,981	28,399,955	100 : 42	811,427	1.48⅔	1,206,321
1900	13,428,422	31,972,433	100 : 45	913,498	1.62	1,479,867
1901	[a] 11,123,194	26,483,795	100 : 42	756,679	1.62	1,225,820

[a] Petroleum and naphtha.

MEXICO.

The opening up of the large gushers of petroleum in Texas, in the early part of 1901, proved the incentive for a large amount of prospecting and the organization of numerous companies in Mexico. The discovery of a large petroleum field in this country would be particularly acceptable, as it is almost destitute of fuel other than wood, and numerous operations in the reduction of precious ores and in general manufacturing industry await the advent of a cheap fuel. The Government encourages prospectors for both petroleum and natural gas by special concessions in the event of finding either.

From the geological conditions that follow the coast line of the Gulf of Mexico from Texas, on the east, as well as from those that follow down the Pacific Ocean from California, on the west, it would seem that similar deposits of petroleum should be found in this Republic. The developments thus far are not of a reassuring nature, as very little petroleum has been found, although there are numerous indications in springs and seeps, and asphaltum deposits as well as sulphur deposits are known. Near many of these surface indications wells have generally failed to find petroleum in paying quantities. It must be remembered, however, that only a very few real tests have been made over the vast area of the Republic.

Recently several new wells located 40 miles west of Tampico, similar to those that have been producing some petroleum for several years at this locality, have found a deposit of very heavy petroleum. The company operating here is composed largely of capitalists from Los Angeles, Cal., and is known as the Mexican Petroleum Company. Five wells have been completed at this locality that have an estimated capacity of 2,000 barrels per day. The petroleum carries 8 per cent water and has a specific gravity of 1.012. From it 42.5 per cent of heavy distillate, ranging from 49° to 27.50° Baumé, was distilled, at from 218° to 360° F., leaving 49.50 per cent of asphaltum. This result indicates that it is a fuel petroleum. A refinery is reported to be under construction at these wells, where it is expected to develop a lighter-gravity petroleum. Near Vera Cruz an English company is preparing to make extensive tests.

The Government imposes a tax of 30 cents per gallon on refined petroleum and 7¼ cents per gallon on crude, imported. The latter is shipped in bulk steamers to Tampico and Vera Cruz from the United States, and by railroad to the City of Mexico, and is refined at all of these localities.

Imports of petroleum and its products from the United States into Mexico, years ending June 30, 1899, 1900, and 1901.

Kind of oil.	1899.		1900.		1901.	
	Gallons.	Value.	Gallons.	Value.	Gallons.	Value.
Crude	7,969,871	$395,386	8,002,845	$455,372	8,356,258	$432,022
Naphtha	73,405	14,169	4,327	1,334	7,158	1,080
Illuminating	581,222	73,312	282,160	51,101	225,172	43,195
Lubricating	605,249	103,999	769,566	156,250	610,923	120,343
Total	9,229,747	586,866	9,058,898	664,057	9,199,511	596,640

PERU.

The development of petroleum in Peru, which occurs chiefly in the province of Piura, the most northerly part of the country, has not made much headway during last year, although work is being carried on in various districts. From the point of view of geology the district is chiefly Tertiary, and closely resembles the Californian oil belt. Among the companies which work the oil deposits is the Faustino Piaggio Petroleum Company, which has a considerable number of wells near Zorritos. It is stated that 20 wells on this property yield 75,000 barrels per annum. The oil obtained therefrom is of a dark-brown color, and the specific gravity varies from 0.81 to 0.84. Kerosene and lubricating oils are obtained from this crude. There is also another, a heavier, petroleum, with a specific gravity of 0.94, worked in this neighborhood in small quantities. An English company, under the name of the Pacific Petroleum Company, also has a large tract of land in which about 60 wells have been sunk, which yield about 1,000 barrels weekly. The average depth of the wells is 500 feet, and it is said that few, if any, have turned out dry ones. The petroleum found here is brown in color, with a specific gravity varying from between 0.834 to 0.848. This oil yielded approximately 30 per cent of kerosene, 10 per cent benzine, and 50 per cent of fuel oil, the balance being loss. In addition to this there is a French company, which has been working for several years past, which obtains about 150 barrels a week from a dozen or so wells sunk. The most serious drawback to the development of these petroleum fields is the lack of water.

Production of petroleum in Zorritos oil field of Peru from 1896 to 1901, inclusive.

[Gallons.]

Year.	Crude petroleum.	Refined.	Lubricating oil.	Benzine.
1896	1,996,520	608,900	896,450	4,560
1897	2,874,980	959,645	964,680	7,940
1898	2,880,000	600,000	1,250,000	8,350
1899	3,745,000	806,900	2,541,000	11,220
1900	4,325,000	[a]400,000	....	13,000
1901	3,135,000	[a]282,430	....	19,060

[a] Kerosene.

COUNTRIES OF THE EASTERN CONTINENT.

RUSSIA.

CONDITION OF THE INDUSTRY.

Since the year 1897 this country has produced more petroleum than the United States. Beginning with 1896, the production has been increasing by an average of over 12 per cent each year to the close of 1901. The increased production is due to the development of larger flowing wells on new lands leased from the Government and to the drilling of the older wells to greater depths. All of the four original fields have shown substantial gains excepting that of Balakhani. The total profitable production for the year 1901 at Baku was 674,543,725 poods, or 80,977,638 barrels of 42 United States gallons, to which must be added 4,190,918 barrels produced at Grosni, nearly 500 miles north of Baku, making a total of 85,168,556 barrels, as compared with 75,779,417 barrels produced in 1900, a gain of 9,389,139, or about 12.4 per cent.

Of the four divisions of the Baku field, that of Sabunchi increased 5,236,000 barrels; Romani, 1,511,000 barrels; Bibi Eibat, 2,930,000 barrels; and the Balakhani division decreased 827,750 barrels, a gain in the Baku field of 8,926,600 barrels in 1901 over 1900.

The net production, which means the actual amount sold, leaving out that part of the gross production used for fuel purposes in operating the wells, the portion lost by evaporation, leakage, and overflow, was, including Grosni, 75,774,319 barrels in 1901 as compared with 67,475,422 barrels in 1900, a net gain of 8,298,897 barrels.

Deeper drilling toward the close of the year opened up a number of prolific fountains in the developed fields. The largest well was completed in the old Bibi Eibat pool, which was drilled to a depth of 1,813 feet and finished with 14-inch casing. It flowed for several days at the rate of 180,000 barrels per day, and then gradually declined. Another large well in the Romani district was finished with 11¼-inch casing at 1,841 feet and was of somewhat smaller proportions.

The Lucas well, near Beaumont, Tex., flowed 70,000 barrels per day for nine days before being shut in through 6-inch casing from a depth of 1,050 feet. The Russian well, with a diameter of 14 inches casing, is 5.5 times larger than the one with 6-inch casing in Texas. Carrying out this proportion, if the Texas well had been finished with 14-inch it would have produced 385,000 barrels, or more than double the quantity produced by this monster in Russia.

Notwithstanding this increased production there were less stocks held at Baku at the end of the year than there were a year previous. The forcing of this vast quantity of refined and fuel oil upon the home markets caused a very sharp decline in values in Russia. The decline from January to the close of the year was close to 50 per cent at Baku. The price in the foreign markets, however, did not suffer a very material decline, as there is usually an agreement binding on all concerned to maintain prices and not force upon the market more than it can carry.

The producer of Russian petroleum is often found working on Government leases on high royalties and a minimum production, in which case he is forced to sell at the market price so as to secure a reduced royalty. About one-third of the total production comes from Government lands. The royalty in the Bibi Eibat field amounts to 5 kopecks per pood, or 21 cents per barrel, and the royalty on the Government lands in other pools is about 8 cents per barrel.

The facilities for handling this large production are at present crude, costly, and wasteful. The markets are far away from the production. The main foreign shipping port at Batum, on the Black Sea, is separated by mountain chains from Baku. To bring the oil to the seaboard, 400 miles of railroad must be traveled to the terminus of the pipe line, and then 160 miles more must be traveled to reach Batum. The capacity of the pipe line is almost double the capacity of the railroad, so that the amount taken to Batum depends upon the capacity of the railroad.

The Volga River is an outlet for 80 per cent of the production, and reaches many miles into the heart of the Russian Empire. It is, however, frozen up for several months in the year and is subject to months of low-water stages in the summer and fall.

At the price of 10 kopecks per pood, equal to 46 cents per barrel, for residuals or fuel oil, allowing 3½ barrels to equal 1 ton of Russian coal, it places the value of $1.61 per ton for coal. When the oil is valued at 11 kopecks per pood, or 51 cents per barrel, it amounts to $1.78 per ton of coal. This is a very fair price for the petroleum and should carry it a long distance to equal the cost of Russian coal, which is high-priced and inferior in quality.

It is this irregular supply and the fluctuating price which interferes with the sale of larger quantities of fuel oil in the great interior of Russia. At the price of 10 kopecks per pood, or 46 cents per barrel, which is considerably larger than the average price for 1901, 8.87 kopecks, it can not fail to secure a market, if transportation could be guaranteed, at prices much in advance of that named for comparison.

During the year 1900 Russia produced only 17,500,000 tons of coal, the higher grades of which sell for 14 to 16 rubles per ton, or about $7 to $8 per ton. The United States produced 270,000,000 tons for the same year. All of the countries bordering on the Mediterranean are destitute of fuel. If it is considered that two-thirds of the total production at Baku now finds a market as fuel oil, this becomes the equivalent of 16,000,000 tons of coal.

To secure a satisfactory price for the crude petroleum and residuum produced at Baku, it is necessary to have a steady supply, which means uninterrupted transportation, as far as possible, with sufficient storage to keep up the deliveries when temporarily interrupted. Until the Russian oil field is better supplied with transportation by pipe lines this irregularity in the delivery must continue. When the pipe line is finished, connecting Baku with Batum, and when another one, now contemplated and much more important, connects Moscow with some port on the Lower Volga, where vessels drawing a moderate depth of water can discharge, the value of this liquid fuel will begin to be appreciated, and the internal industry of this great country will receive the benefits to which it is entitled from nature's bounty.

Another serious drawback to the proper home consumption of illuminating oil is the excise tax levied on this article by the Government, amounting to 60 kopecks, or 30.9 cents per pood of 36.11 pounds, or $2.47 per barrel—almost 6 cents per gallon. This tax nets the Government $10,300,000 annually. The tax on crude petroleum Government lands is excessive, amounting in some cases to 40 per cent of the output, based on a minimum production, so that the operator is compelled to sell at almost any price to secure even this rate. One of the main features in the political economy of the most successful nations of the world is to provide cheap fuel—the mainspring that keeps the wheels of the manufacturing industry in motion. Russia for years has possessed large quantities of the cheapest fuel in the world, but her people have not been in position to reap the greatest benefits from it.

The Survey's report concerning Russian production is supplemented by the report of United States Consul Chambers, of Batum.

PRODUCTION.

The following tables show the production of Russia from 1897 to 1901, inclusive, together with a comparison of the yearly output of Russia and the United States from 1895 to 1901, inclusive, the gain or loss each year for each country, the percentages of these, and the percentage of the Russian production compared to that of the United States taken as the unit. It is to be remembered that these two countries produce over 93 per cent of the world's entire output of petroleum.

Total production of crude petroleum in Russia, 1897 to 1901, inclusive.

[Barrels of 42 gallons.]

Year.	Apsheron Peninsula.	Grosni.	Total.
1897	51,645,568	2,754,000	54,399,568
1898	59,409,357	2,200,000	61,609,357
1899	63,048,909	2,906,059	65,954,968
1900	72,120,493	3,658,924	75,779,417
1901	80,977,638	4,190,918	85,168,556

Comparative production of crude petroleum of Russia and the United States, 1894–1901.

[Barrels of 42 gallons.]

Year.	Russia.			United States.			Production of Russia in percentage of production of United States.
	Profitable production.	Gain.	Percentage of gain.	Production.	Gain or loss.	Percentage of gain or loss.	
1894	36,375,428			49,344,516			73.7
1895	46,140,174	9,764,746	+26.8	52,892,276	3,547,760	+ 7.19	87.2
1896	47,220,633	1,080,459	+ 2.3	60,960,361	8,068,085	+15.25	77.4
1897	54,399,568	7,178,935	+15.2	60,475,516	− 484,845	− .80	89.9
1898	61,609,357	7,209,789	+13.3	55,364,233	−5,111,283	− 8.45	111.3
1899	65,954,968	4,345,611	+ 7.05	57,070,850	1,706,617	+ 3.08	115.5
1900	75,779,417	9,824,449	+14.9	63,620,529	6,549,679	+11.50	119.1
1901	85,168,556	9,389,139	+12.4	69,389,194	5,768,665	+ 9.07	122.7

A careful estimate of the production of crude petroleum in all of the known countries of the world in 1901 from which it is possible to gather statistics has made this quantity 165,385,733 United States barrels.

This great total was produced largely from Russia and the United States; the following table gives the percentages for these two countries and for all other countries combined:

Percentages of world's production of petroleum in 1901 by countries.

Percentage of total crude petroleum produced by Russia	51.50
Percentage of total crude petroleum produced by the United States	41.95
Percentage of all other countries producing petroleum	6.55
Total	100.00

EXPORTS FROM RUSSIA.

The total exports of petroleum, crude and refined, from Batum and Novorossisk for 1901 to foreign ports were as follows:

Exports of petroleum from Russia in 1901.

Export from Batum, in United States gallons	390,920,095
Export from Novorossisk, in United States gallons	69,329,435
Total	460,249,530
Less the amount to Russian ports	31,592,320
Total exported	428,657,210

The total exports of petroleum, crude and refined, from the ports of New York, Philadelphia, Baltimore, Charleston, and Galveston in 1901 were, in United States gallons, 1,062,750,306. Compared with each other, the exportation of petroleum from Russia was 40.33 per cent of that of the United States.

GALICIA.

PRODUCTION AND CONSUMPTION.

In the following table is given a statement of the production of crude petroleum in Galicia from 1886 to 1901, inclusive, as ascertained by the Statistical Bureau of the Galizischer Landes-Petroleum-Verein, Lemberg:

Production of crude petroleum in Galicia from 1886 to 1901, inclusive.

Year.	Quantity.		Year.	Quantity.	
	Metric centners.	*Barrels of 42 gallons.*		*Metric centners.*	*Barrels of 42 gallons.*
1886	425,400	305,884	1894	1,320,000	949,146
1887	478,176	343,832	1895	2,020,720	1,452,999
1888	648,824	466 537	1896	3,397,650	2,443,080
1889	716,595	515,268	1897	3,096,263	2,226,368
1890	916,504	659,012	1898	3,304,510	2,376,108
1891	877,174	630,732	1899	3,216,810	2,313,047
1892	898,713	646,220	1900	3,263,340	2,346,505
1893	963,312	692,669	1901	4,522,000	3,251,544

The following table gives a statement of the number of productive completed wells, the number of wells drilling, and the production of crude petroleum in Galicia during the year 1901, by districts:

Production of crude petroleum in Galicia in the year 1901, by districts.

District.	Wells.		Oil-producing undertakings.	Production.	
	Productive, drilled in 1901.	Drilling in 1901.		Metric centners.	United States barrels.
Neu-Sandec	12	2	52	270,000	194,143
Gorlice					
Jaslo	14	6	29	680,000	488,954
Krosno					
Brzozow	11	5	13	60,000	43,143
Sanok					
Lisko	14	7	13	300,000	215,715
Chyrow					
Drohobycz	11	3	70	3,095,000	2,225,460
Nadworna	7	6	29	117,000	84,129
Kolomea					
Total	69	29	206	4,522,000	3,251,544

ROUMANIA.

CONDITION OF THE INDUSTRY.

There has been a steady increase in the production of petroleum in this country for a number of years, with the exception of that of 1901, when the output was 1,406,160 barrels, as compared with 1,628,535 in 1900, a decline of 222,375 barrels. The methods of raising the petroleum continue to be in a great measure of a crude nature, as a large proportion comes from the primitive hand-driven wells or shafts. The real resources of this country as a producer of petroleum have not been developed to their full extent, except in a few instances. Lack of capital and commercial experience, as well as lack of practical and theoretical experience of the operators, are in a great measure responsible for the present condition of the trade in Roumania, which in experienced hands ought to become a far greater factor in the general production of that country than it is at present, because of its central location and of the superior quality of the petroleum produced from reasonable depths. There are no pipe lines of any length reaching the ports on the Danube or those on the Black Sea from the producing regions, which are located many miles inland on the flanks of the Carpathian Mountains. Those in existence merely connect the pools with the nearest railroad. Roumania should encourage the active and successful development of the petroleum trade to protect herself, as the country is almost destitute of coal, which it imports at extravagant prices for a large proportion of its railroads and other industries; whereas if the petroleum fields were properly developed large quantities of residual fuels, amounting to 40 per cent of the crude, would necessarily be placed upon the fuel market. There are also possibilities of deposits of natural gas in the gentle folds of the strata along the flanks of the mountain chain that have not been properly tested.

The new development during the year has been generally satisfactory, and a number of large-producing wells, ranging from 40 to 400 barrels per day, were secured. Five producing wells were recently drilled at Baicoi, 3 at Poiana, 1 at Vrajitoare, 1 at Consmina, 1 at Paeureti, and at Telega 6 were completed during the past year, which has for a time greatly increased the output of crude petroleum and caused a decline in the price. The wonderful fountains developed at Baku, Russia, and about the same time in Texas in the United States, causing a great decline in the price of both refined and crude petroleum in that country, had a depressing effect upon the trade generally in Roumania also, causing the price of crude petroleum to decline from $1.05 per barrel to 92 cents. The price of refined petroleum was fairly well maintained, owing principally to the existence of a combination among the refiners, the price being kept at 10 francs per 100 kilograms, equal to $2.40 per barrel, or 5.7 cents per gallon. Of the refined petroleum 55 per cent was consumed at home, and about 45 per cent is exported to a large number of foreign countries. The price of refined or illuminating petroleum is therefore quite reasonable compared to what the subjects of Russia pay, as the tax imposed by the Government in that country is alone $2.45 per barrel, or 6 cents per gallon, to which must be added the cost of production and other expenses.

The tables following give the production of the different districts for a number of years, the proportions of benzine, illuminating, and lubricating oils, and the amount of residuum produced, by months and by districts, also the quantity exported to the several countries named during 1901.

There were no importations from the United States to Roumania, as this country exported largely.

PRODUCTION.

The following statement, furnished by the Imperial and Royal Austro-Hungarian consulate in Plojest, gives the production of crude petroleum in Roumania from 1896 to 1901, by districts:

Production of crude petroleum in Roumania from 1896 to 1901, inclusive, by districts.

[Tank carloads of 100 metric centners=22,046 pounds.]

District.	Production.					
	1896.	1897.	1898.	1899.	1900.	1901.
Baicoi	250	250	340	800	950	880
Glodeni	1,365	350	1,925	2,300	2,800	2,200
Campina	300	1,460	2,650	8,500	9,400	9,580
Dolftana and Bustenari	2,960	3,830	2,730	3,860	4,100	5,500
Ochisori and Matitza	178	150	160	380	500	265
Sarata (Buzen)	902	700	1,185	1,890	2,400	475
Tega						
Other localities	1,602	1,200	1,667	2,100	2,500	700
Total	7,557	7,940	10,657	19,830	22,650	19,600

In the following table will be found the production of crude petroleum in the principal districts in Roumania from 1874 to 1901, inclusive:

Production of crude petroleum in Roumania by districts from 1874 to 1901, inclusive.

[Tank cars of 22,046 pounds reduced to barrels of 42 gallons.]

Year.	District.				Total.	
	Prahova.	Buzau.	Bacau.	Dimbo-vita.	Tank cars.	Barrels (42 U. S. gallons).
1874	155	780	220	280	1,435	103,176.5
1875	160	820	230	300	1,510	108,569
1876	150	760	280	320	1,510	108,569
1877	180	760	250	320	1,510	108,569
1878	210	750	250	300	1,510	108,569
1879	250	700	280	300	1,530	110,007
1880	290	710	300	290	1,590	114,321
1881	350	740	300	300	1,690	121,511
1882	540	700	310	350	1,900	136,610
1883	570	700	320	350	1,940	139,486
1884	1,560	700	300	370	2,930	210,667
1885	1,350	700	300	340	2,690	193,411
1886	880	750	290	425	2,345	168,605.5
1887	950	800	280	500	2,530	181,907
1888	890	840	360	950	3,040	218,576
1889	950	1,010	380	1,800	4,140	297,666
1890	1,030	1,100	600	2,600	5,330	383,227
1891	1,150	1,050	790	3,800	6,790	488,201
1892	1,600	1,100	850	4,700	8,250	593,175
1893	1,700	950	1,300	3,500	7,450	535,655
1894	2,600	925	1,650	1,880	7,055	507,254.5
1895	3,714	904	1,838	1,544	8,000	575,200
1896	3,688	902	1,602	1,365	7,557	543,348
1897	5,690	700	1,200	350	7,940	570,886
1898	5,880	1,185	1,667	1,925	10,657	766,238
1899	13,540	1,890	2,100	2,300	19,830	1,425,777
1900	14,950	2,400	2,500	2,800	22,650	1,628,535
1901	16,225	475	700	2,200	19,600	1,406,160

GERMANY.

RÉSUMÉ OF THE INDUSTRY.

This country showed a decrease in production during 1901, the output being 313,630 barrels, as compared with 358,297 barrels in 1900, and with 192,232 barrels in 1899. The value showed a corresponding decrease also in 1901. The remarkable increase in the quantity of petroleum produced in Germany in 1900 was due to the output of the old Hanover field in Prussia, near Celle, which was revived after being practically abandoned for many years. During the year 1900 the Hanover field produced 55 per cent and the Alsace field 45 per cent.

By careful manipulation in the refining a superior lubricating petroleum is manufactured from the products of both of these fields. The principal refineries in the Alsace field are at Pechebroun and Bodromstein, and that near Celle, in the Hanover field, is located at Piene. The petroleum found in Alsace is of a gravity of 28° Baumé, and that in the Hanover field is considerably heavier. Twenty-five per cent of illuminating petroleum is said to be extracted from the petroleum of Alsace as well as over 30 per cent of lubricating oils, and not over 16 per cent of illuminating petroleum is secured from the Hanover field, but the percentage of lubricating petroleum is said to be over 37 per cent.

Germany encourages the development of her petroleum fields by imposing on all of the petroleum products brought into the country a heavy import duty amounting to 6 marks per 100 kilos, or $1.80 per barrel, on illuminating petroleum, and to 10 marks per 100 kilos on lubricating petroleum, or $2.99 per barrel.

The entire production of Germany is however small, when it is compared with the consumption of petroleum from other countries. During the year 1901 the imports from the United States, Russia, Austria-Hungary, and Roumania amounted to 4,657,000 barrels, as compared to 313,630 barrels produced in Germany, which represent about 7 per cent of the amount imported.

The United States exported to Germany in 1901, 3,691,000 barrels of all grades; Russia exported 573,000 barrels; Austria-Hungary 250,000 barrels, and Roumania 143,000 barrels, a total of 4,657,000 barrels.

PRODUCTION.

The production and value of petroleum in Germany from 1880 to 1901 is shown in the following table:

Production and value of petroleum in Germany from 1880 to 1901, inclusive.

[Metric ton=7.1126 barrels.]

Year.	Production.		Value.	
	Metric-tons. [a]	Barrels (42 gallons).	Marks. [b]	Dollars.
1880	1,309	9,310	159,000	38,160
1881	4,108	29,219	526,000	126,240
1882	8,158	58,025	751,000	180,240
1883	3,755	26,708	352,000	84,480
1884	6,490	46,161	551,000	132,240
1885	5,815	41,360	471,000	113,040
1886	10,385	73,864	962,000	230,880
1887	10,444	74,284	933,000	223,920
1888	11,920	84,782	1,028,000	246,720
1889	9,591	68,217	881,000	211,440
1890	15,226	108,296	1,242,000	298,080
1891	15,315	108,929	1,195,000	286,800
1892	14,257	101,401	880,000	211,200
1893	13,974	99,391	783,000	187,920
1894	17,232	122,564	972,447	233,387
1895	17,051	121,277	962,455	230,989
1896	20,395	145,061	1,188,511	285,243
1897	23,303	165,745	1,396,444	335,147
1898	25,789	183,427	1,578,208	378,770
1899	27,027	192,232	1,577,456	378,589
1900	50,375	358,297	3,726,086	894,261
1901	44,095	313,630	2,950,478	708,115

[a] One metric ton crude=7.1126 barrels. [b] One mark taken as=24 cents.

ITALY.

The statistics for the petroleum production in Italy for 1901 are not yet available. That of 1900 was 12,102 barrels, as compared with 16,121 barrels in 1899. The production for several years has been quite regular; that of 1900, however, shows a decline of 4,019 barrels. There was a slight increase in the price, as $7.84 is quoted as the average value for 1900. This price ought to stimulate the search for petroleum, and in a way it no doubt has, but the methods employed in Italy are rather crude. The duty imposed on refined petroleum causes the high price of the native production. There is an import duty amounting to 48 lires per 100 kilos, or $11.50 per barrel, as well as an excise duty of $2.25 per barrel.

A great variety of petroleum is found in Italy, ranging from the dark or black of heavy gravity to that almost equal in color to refined petroleum. This petroleum is usually found in anticlinals parallel to the Apennine range and is associated with sulphur and saline springs.

The production amounts to a fraction under 2 per cent of the amount imported from the United States, Russia, Austria, and Roumania, as approximately 720,000 barrels were imported by Italy in 1900 from those countries. The Government reports give a large amount of detail, as the following table will show:

PRODUCTION.

From the volumes of Rivista del Servizio Minerario the following statements are extracted regarding the production of crude and refined petroleum in this country:

Production of crude petroleum in Italy from 1860 to 1900, inclusive.

Year.	Number of wells in operation.	Quantity.		Value.				Number of workmen employed.
				Unit value.		Total value.		
		Metric tons.	United States barrels.	Lire.	Dollars.	Lire.	Dollars.	
1860	3	5	36	800.00	21.44	4,400	772	5
1861	3	4	29	800.00	21.31	3,200	618	8
1862	4	4	29	800.00	21.31	3,200	618	9
1863	7	8	58	800.00	21.29	6,400	1,235	18
1864	7	10	72	800.00	21.44	8,000	1,544	32
1865	10	315	2,265	209.52	5.62	66,000	12,738	70
1866	12	138	992	269.86	7.24	37,240	7,187	57
1867	11	110	791	349.10	9.37	38,400	7,411	58
1868	9	51	367	435.29	11.68	22,200	4,285	52
1869	8	20	144	800.00	21.65	16,000	3,118	45
1870	6	12	86	800.00	21.55	9,600	1,853	30
1871	6	38	273	263.16	7.07	10,000	1,930	40
1872	6	46	331	208.69	5.60	9,600	1,853	36
1873	5	65	467	172.31	4.63	11,200	2,162	35
1874	4	84	604	152.38	4.09	12,800	2,470	37
1875	3	113	813	138.05	3.70	15,600	3,011	38
1876	3	402	2,891	123.38	3.31	49,600	9,573	72
1877	2	408	2,934	132.35	3.55	54,000	10,422	45
1878	4	602	4,329	102.99	2.76	62,000	11,966	98
1879	4	402	2,891	124.37	3.34	50,000	9,650	70
1880	2	283	2,035	313.05	8.40	88,595	17,099	24
1881	2	172	1,237	445.00	11.94	76,540	14,772	24
1882	4	183	1,316	474.55	11.98	86,844	15,761	121
1883	5	225	1,618	259.49	6.96	58,387	11,269	92
1884	6	397	2,855	341.18	9.16	135,452	26,142	110
1885	6	270	1,941	407.65	10.94	110,066	21,243	136
1886	7	219	1,575	416.11	11.17	91,130	17,588	145
1887	7	208	1,496	368.84	9.77	76,720	14,614	135
1888	5	174	1,251	319.71	8.58	55,630	10,737	75
1889	7	177	1,273	288.13	7.73	51,000	9,843	70
1890	9	417	2,998	289.21	7.76	120,603	23,276	177
1891	10	1,155	8,305	301.38	8.09	348,100	67,183	251
1892	7	2,548	18,321	296.11	7.95	754,500	145,619	267
1893	8	2,652	19,069	299.80	8.05	795,050	153,445	130
1894	9	2,854	20,522	296.88	7.97	847,260	163,521	194
1895	6	3,594	25,843	358.90	6.95	930,496	179,586	134
1896	9	2,524	18,149	255.34	6.85	644,468	124,383	222
1897	8	1,932	13,892	255.33	6.84	492,288	95,010	231
1898	7	2,015	14,489	292.30	7.85	589,129	113,702	217
1899	6	2,242	16,121	264.97	7.11	594,062	114,654	231
1900	9	1,683	12,102	292.20	7.84	491,769	94,911	226

7.1905 barrels=1 metric ton of crude.
7.955 barrels=1 metric ton of refined.
1 lira=19.3 cents.

GREAT BRITAIN.

PRODUCTION, VALUE, AND CONSUMPTION.

The mineral statistics of the United Kingdom give the production and value of petroleum from 1886 to 1901 as follows:

Production and value of petroleum in Derbyshire, England, from 1886 to 1901, inclusive.

Year.	Production.		Value.[a]	
	Tons (2,240 pounds).	Barrels (42 gallons).	Pounds.	Dollars.
1886	43	314	129	627
1887	66	482	99	481
1888	35	256	....	....
1889	30	219	45	219
1890	35	256	52	253
1891	100	731	150	729
1892	218	1,594	409	1,988
1893	260	1,900	488	2,372
1894	49	358	92	448
1895	15	110	28	136
1896	12	88	29	141
1897	12	88	29	141
1898	6	44	14	68
1899	5	37	12	58
1900	....	....	....	....
1901	8	59	....	....

[a] Value at wells, £1=$4.86.

The United Kingdom is the greatest consumer of petroleum products manufactured in the United States, and in 1901 consumed 206,198,737 United States gallons, amounting to 19.4 per cent of the entire export of the United States. Of the total imports of petroleum and its products consumed by the United Kingdom, the United States furnished 64 per cent and Russia close to 31 per cent, leaving 5 per cent to be furnished by all the other countries.

Several cargoes of fuel petroleum from Texas reached England during the latter portion of 1901, transported by the Shell Transportation Line in tank steamers, one of whose steamers, the *Calm*, crossed the Atlantic and reached the port of Philadelphia in the United States, using crude petroleum as fuel entirely. This company owns 18 tank steamers, engaged in establishing depots of fuel petroleum reaching from Hongkong to London.

THE SCOTCH SHALE-OIL INDUSTRY.

The shale-oil industry of Scotland is of no small importance, and the quantity worked has increased very considerably during the last twenty years. The mineral is obtained chiefly in Edinburghshire and Linlithgowshire from seams in the Calciferous sandstone at the base of the Carboniferous rocks. The following article is taken from the London Economist:

It may be explained that the oil companies of Scotland are engaged in the destructive distillation of oil shale, which is found chiefly in the Lothians, and which is mined like coal. By the retorting of this shale an oil is produced analogous to the crude petroleum from the natural oil wells of America and Russia; and in the retorting and refining processes various products are obtained and utilized which formerly went to waste. It is by the utilization of these waste products that the Scotch industry has been able to stand against the flood of natural oil in America. And the marvel of the industry has been the ingenuity with which the shale has been made to yield previously unknown values and virtues, and the skill with which the cost of manufacture has been steadily brought down. Only by increased extraction and decreased expenditure has the Scotch industry been able to survive through long years of adversity.

First of all, by distilling the shale in retorts, crude oil and ammonia water are produced. The crude oil is sent to the refinery, and there treated with vitriol and caustic soda and other manipulations, is made to yield paraffin, or burning oil, a series of heavy oils for lubricating purposes, a volatile spirit or naphtha, which is used as a substitute for turpentine, as a solvent and also as an illuminant, and a solid residuum, called scale, or wax, which is used for candle making, matchmaking, waterproofing, and a great variety of purposes. The other product of distillation, ammonia water, used formerly to run to waste. It is now converted into that valuable fertilizer, sulphate of ammonia. It will thus be seen that the Scotch oil companies are dependent on a great variety of industries for the marketing of their products, as well as on the domestic consumption of burning oil. Among them they produce about 500,000 barrels of burning oil per annum, probably 250,000 barrels of lubricating and other oils, and approximately 160,000 barrels of naphtha, 20,000 tons of solid paraffin, and 20,000 tons of sulphate of ammonia. Now the prices of all these products were high last year. In the annexed table is a comparison of the average prices of the last three years (reduced to United States currency):

	1899.	1900.	1901.
Illuminating oil .... per gallon..	$0.11½	$0.13	$0.13
Lubricating oil .... per long ton..	32.40	37.20	36.00
Naphtha .... per gallon..	.19½	.20	.15
Paraffin scale .... per pound..	.05¼	.07¼	.05¼
Sulphate of ammonia .... per ton..	60.00	54.00	51.00

In the following table is given the quantity and value of oil shale produced in Great Britain during the years 1897, 1898, 1899, and 1900.

Quantity and value of oil shale produced in Great Britain in 1897, 1898, 1899, and 1900.

Country.	1897.		1898.		1899.		1900.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Tons.		*Tons.*		*Tons.*		*Tons.*	
England	10,568	£2,642	2,975	£744	200	£50	....	....
Scotland	2,211,617	552,904	2,133,409	533,352	2,208,249	552,062	2,279,879	£626,966
Wales	1,560	390	1,609	402	2,375	891	2,342	878
Total......	2,223,745	555,936	2,137,993	534,498	2,210,824	553,003	2,282,221	627,844

The quantity and value of oil shale produced in Great Britain from 1873 to 1901 are shown in the following table:

Production of oil shale in the United Kingdom from 1873 to 1901, inclusive.

Year.	Quantity.	Value.	Year.	Quantity.	Value.
	Statute tons.			*Statute tons.*	
1873	524,095	£262,047	1888	2,076,469	£519,074
1874	362,747	181,373	1889	2,014,860	503,715
1875	437,774	218,887	1890	2,212,250	608,369
1876	603,538	301,769	1891	2,361,119	707,177
1877	801,701	400,850	1892	2,089,937	522,484
1878	788,704	394,352	1893	1,956,520	489,130
1879	783,748	391,824	1894	1,986,385	496,596
1880	837,805	418,902	1895	2,246,865	561,716
1881	958,255	479,127	1896	2,419,525	604,881
1882	1,030,915	310,685	1897	2,223,745	555,936
1883	1,167,943	299,676	1898	2,137,993	534,498
1884	1,518,871	386,780	1899	2,210,824	553,003
1885	1,770,413	447,302	1900	2,282,221	627,844
1886	1,728,503	435,963	1901	2,354,356	....
1887	1,411,378	355,085			

NEW SOUTH WALES.

PRODUCTION OF KEROSENE SHALE.

The quality and value of the kerosene shale wrought in the two districts from which it was produced during the years 1899 and 1900 were as follows:

Quantity and value of kerosene shale wrought in New South Wales in 1899 and 1900.

[Annual Report of the Department of Mines, New South Wales.]

Year.	Western division.		Southwestern division.		Total.	
	Tons.	Value.	Tons.	Value.	Tons.	Value.
		£ s. d.		£ s. d.		£ s. d.
1899	29,193	31,415 5 0	7,526	9,408 5 0	36,719	40,823 5 0
1900	21,896	19,444 13 0	966	1,207 0 0	22,862	20,651 13 0

The number of persons employed during 1900 was 158, as against 184 in the year 1899, a decrease of 26. The following table gives the number of persons employed at the mines, and the output of the respective mines, during 1900:

Number of persons employed and output of mines of New South Wales in 1900.

Mines.	District.	Total number of persons employed.	Quantity.	Value.
Western division:			*Tons.*	£ s. d.
Genowlan	Capertee	38	8,174	10,217 0 0
Hartley Vale	Hartley	19	7,111	2,037 5 0
New Hartley	Capertee	73	6,611	7,190 8 0
Total		130	21,896	19,444 13 0
Southern district:				
Joadja	Mittagong	28	966	1,207 0 0
Total		28	966	1,207 0 0
Total for all mines		158	22,862	20,651 13 0

The production of oil shale is gradually decreasing, and there are several reasons for this, among which are—

(1) The area of known first-class shale is getting quickly worked out.

(2) The freights for exporting shale have been so high as to limit the quantity exported.

(3) Recently certain oils have been used to increase the illuminating power of gas, which to a large extent is taking the place of oil shale for this purpose.

The following table shows the quantity and value of kerosene shale produced in New South Wales from 1865 to 1900, inclusive:

Quantity and value of kerosene shale produced in New South Wales, 1865–1900.

Year.	Quantity.	Average price per ton.			Total value.			Year.	Quantity.	Average price per ton.			Total value.		
	Tons.	£	*s.*	*d.*	£	*s.*	*d.*		*Tons.*	£	*s.*	*d.*	£	*s.*	*d.*
1865......	570	4	2	5.47	2,350	0	0	1884.....	31,618	2	5	7.86	72,176	0	0
1866......	2,770	2	18	10.48	8,150	0	0	1885.....	27,462	2	8	11.62	67,239	0	0
1867......	4,079	3	14	9.21	15,249	0	0	1886.....	43,563	2	5	10.79	99,976	0	0
1868......	16,952	2	17	7.11	48,816	0	0	1887.....	40,010	2	3	10.43	87,761	0	0
1869......	7,500	2	10	0.00	18,750	0	0	1888.....	34,869	2	2	2.66	73,612	0	0
1870......	8,580	3	4	3.18	27,570	0	0	1889.....	40,561	1	18	3.55	77,666	15	0
1871......	14,700	2	6	3.91	34,050	0	0	1890.....	56,010	1	17	2.07	104,103	7	6
1872......	11,040	2	11	11.91	28,700	0	0	1891.....	40,349	1	18	8.77	78,160	0	0
1873......	17,850	2	16	6.55	50,475	0	0	1892.....	74,197	1	16	8.16	136,079	6	0
1874......	12,100	2	5	1.48	27,300	0	0	1893.....	55,660	1	16	4.44	101,220	10	0
1875......	6,197	2	10	2.22	15,500	0	0	1894.....	21,171	1	10	0.28	31,781	5	0
1876......	15,998	3	0	0.00	47,994	0	0	1895.....	59,426	1	5	3.78	75,218	18	8
1877......	18,963	2	9	0.81	46,524	0	0	1896.....	31,839	1	1	5.81	34,201	18	0
1878......	24,371	2	6	11.40	57,211	0	0	1897.....	34,090	1	3	9.91	40,611	15	0
1879......	32,519	2	1	1.96	66,930	0	0	1898.....	29,689	1	1	5.34	31,834	0	0
1880......	19,201	2	6	7.03	44,724	15	0	1899.....	36,719	1	2	2.83	40,823	5	0
1881......	27,894	1	9	2.59	40,748	0	0	1900.....	22,862	0	18	0.79	20,651	13	0
1882......	48,065	1	15	0.00	84,114	0	0	Total..	1,018,694	1	17	10.49	1,929,133	18	2
1883......	49,250	1	16	10.77	90,861	10	0								

DUTCH EAST INDIES—SUMATRA, JAVA, AND BORNEO.

CONDITION OF THE INDUSTRY.

The reports for 1901 from these far-off islands are slow in reaching the centers of trade in Europe and the United States.

The reports usually cover the number of cases of finished products, so that the production of the crude petroleum has to be estimated. There is no doubt this region has some remarkably pure native petroleum with a paraffin base, which, if properly refined, ought to produce an excellent article of illuminating petroleum. The refineries generally, however, seem to find it more profitable to manufacture a second grade, which is sold at a low price in markets near the points of manufacture, a very small proportion reaching the European markets.

Sumatra.—The producing regions in Sumatra have caused considerable disappointment, owing to the sudden falling off of production. This caused a search for other localities, which in time were found, but proved not so productive as the original field of Langkat; yet the past year has shown a considerable increase in output. The principal producing and refining companies are the Royal Dutch Company, of Holland; the Sumatra Palembang Company, and the Mocara Enim Company, which control the greater portion of the refining interests in Sumatra. Without complete returns, the production of crude petroleum in Sumatra in 1901 is placed at 2,020,700 barrels, 58 per cent of which comes from the Langkat field, 28 per cent from the Palembang field, and 14 per cent from the Mocara Enim field. This amount is a considerable increase over the output of the year 1900.

Java.—The petroleum produced on this island usually contains a very large percentage of paraffin, from which is made candles in considerable quantity. Some of the crude is as light in gravity as that of Pennsylvania; other varieties are dark and heavy. The petroleum is produced principally by the Dordtsche Petroleum Company and the Java Petroleum Company, the former operating in the residency of Soerabaya and Panolaw, the latter in the residency of Rembang. The entire production of crude petroleum in Java in 1901 is estimated to be 613,000 barrels.

Borneo.—There was considerable activity on the part of the Royal Dutch Company on the eastern coast, in the province of Koetei. The production is estimated at 405,000 barrels. There is a refinery also in the province of Koetei operated by the Shell Company.

PRODUCTION.

The production of these three islands is estimated as follows for the year 1901:

Production of petroleum in Sumatra, Java, and Borneo in 1901.

Country.	Barrels.
Sumatra	2,020,700
Java	613,000
Borneo	405,000
Total	3,038,700

We are indebted to Mr. Adrian Stoop, of the Dordtsche Petroleum Maatschappij, for the following table, giving the production of refined petroleum in Sumatra from 1892 to 1901, inclusive:

Production of refined petroleum in Sumatra from 1892 to 1901, inclusive.

Year.	Quantity.		
	Cases.	Liters.	Gallons.
1892	144,703	5,209,308	1,376,303
1893	401,370	14,449,320	3,817,149
1894	1,042,943	37,545,948	9,919,670
1895	1,334,249	48,032,964	12,690,347
1896	1,851,512	66,654,432	17,616,154
1897	4,564,987	164,339,532	43,418,635
1898	5,553,600	199,929,600	52,821,560
1899	2,543,050	91,549,800	24,187,530
1900	3,837,600	145,061,280	38,324,960
1901 (estimated)	5,658,000	213,872,400	56,580,000

1 case=37.8 liters=9.9867 gallons.
1 liter=61.02 cubic inches.
1 gallon=231 cubic inches.
1 quart=57.75 cubic inches.

In the following table are given statistics of the production of refined petroleum in Sumatra, by districts and months, from 1898 to 1901, in cases:

Production of refined petroleum in Sumatra from 1898 to 1901, inclusive.

[Cases.]

Month.	Royal Langkat.				Palembang.			Moeara Enim.	
	1898.	1899.	1900.	1901.	1899.	1900.	1901.	1900.	1901.
January	520,000	205,000	137,000	203,800	43,500	96,500	70,000	6,970	467,100
February	580,000	170,500	106,500	223,000	49,000	84,000	42,000	33,030	
March	710,000	171,000	111,000	272,000	31,000	96,000	41,000	50,000	
April	740,000	160,000	109,900	252,000	58,000	73,500	35,000	62,500	478,000
May	839,000	149,500	106,000	280,000	56,000	79,000	43,000	124,300	
June	471,000	137,000	100,000	282,500	49,000	76,000	50,000	214,000	
July	382,500	127,500	90,000	283,000	42,000	59,000	70,000	228,200	....
August	300,000	129,000	92,500	285,000	75,000	54,000	96,500	224,800	....
September	270,000	133,500	82,500	282,000	68,000	47,000	56,000	180,700	....
October	250,000	129,000	86,500	302,300	67,000	38,000	82,500	169,800	648,600
November	270,500	128,500	143,000	307,000	63,000	44,000	91,000	203,100	
December	221,500	164,500	185,500	322,400	92,500	50,000	93,000	192,800	
Total	5,554,500	1,805,000	1,350,400	3,295,000	694,000	797,000	770,000	1,690,200	1,593,700

The production of petroleum in Java for eight years past is shown in the following table, in gallons:

Production of crude petroleum in Java from 1893 to 1900, inclusive.

Year.	Quantity.	Year.	Quantity.
	Gallons.		*Gallons.*
1893	16,800,000	1897	22,857,631
1894	7,056,000	1898	24,481,917
1895	12,333,468	1899	25,839,200
1896	21,211,203	1900 (estimated)	19,500,000

The following statistics, given by the Dordtsche Petroleum Industry Maatschappij, Java, show their production of crude and refined petroleum from 1895 to 1901 in the districts of Soerabaya and Rembang:

Production of petroleum in Java from 1895 to 1901, inclusive, by districts.

Year.	Residency of Soerabaya.		Residency of Rembang.	
	Crude.	Refined.	Crude.	Refined.
	Gallons.	*Cases.*	*Gallons.*	*Cases.*
1895	8,915,088	525,004	3,418,380	222,904
1896	11,069,668	604,418	10,141,535	638,916
1897	11,224,131	627,966	7,458,373	791,431
1898	9,473,000	542,845	9,317,162	947,493
1899	6,597,429	601,476	7,701,340	862,326
1900	7,272,222	552,845	14,035,564	1,094,269
1901	7,447,888	500,551	5,042,242	[a] 1,001,996

[a] Includes crude oil bought from other companies and refined at Rembang.

JAPAN.

CONDITION OF THE INDUSTRY.

Nearly the entire supply of petroleum produced in Japan comes from the province of Echigo, on the northwest coast, near the center of the main island of Nippon. The main deposit thus far developed comes from the Ugamine and Kamada fields, northeast from Kashiwazaki. South of these fields there are other localities that have produced some petroleum. There is a refinery in operation at Kashiwazaki, on the coast, and one in process of erection at Naoetsu in which American capitalists, under the title of the International Oil Company, are interested. They have acquired territory both in the province of Echigo and in Hokkaido also, and are introducing modern methods of drilling and operating oil territory. The records of the production in Japan for 1901 are not yet obtainable, although those for 1899 and 1900 have been recently secured. The production for 1900 is given as 22,175,825 gallons, equal to 528,000 barrels. Although there is considerable increase in the production of new wells in territory lately developed, there is a large falling off in the production of the old wells that has in several instances caused the estimates on the production to be too great. It is probable that the production for 1901 will show an increase of 15 per cent over that of 1900, and will approximate 600,000 barrels.

The depth of the wells in the Echigo Province range from 800 to 1,600 feet, and the gravity of the petroleum ranges from 27° to 35° Baumé. The crude petroleum produced in Japan will not yield more that 60 per cent of the lighter products and lubricating petroleum, which was 360,000 barrels, approximately, in 1901, while the importations for the same year from the United States, Russia, and other countries must amount to 69,000,000 gallons, or 1,643,000 barrels. This indicates that Japan only furnishes 22 per cent of the total refined products of petroleum, leaving 78 per cent to be imported from other countries. Of this amount 85 per cent was furnished by the United States.

PRODUCTION.

Production of petroleum in Japan, 1875 to 1900, inclusive.

Year.	Production.				Value received for crude and refined sold.	
	Crude.		Refined.[a]			
	Koku.[b]	Gallons.	Koku.[b]	Gallons.	Yen.[c]	Dollars.
1875	4,830	191,751	....	....	....	....
1876	8,155	323,753	....	....	....	....
1877	10,114	401,526	....	....	....	....
1878	18,920	751,124	....	....	....	....
1879	24,816	985,195	....	....	....	....
1880	26,974	1,070,868	....	....	....	....
1881	17,721	703,524	....	....	....	....
1882	16,450	653,065	....	....	....	....
1883	21,659	859,862	....	....	....	....
1884	29,541	1,172,778	6,215	246,735	107,964	92,633
1885	30,931	1,227,961	7,326	290,842	98,496	84,510
1886	40,113	1,592,486	13,487	535,434	136,911	110,898
1887	30,304	1,203,069	8,830	350,551	126,298	99,018
1888	39,605	1,572,318	4,511	179,087	138,602	104,367
1889	55,871	2,218,079	7,097	281,751	250,977	184,217
1890	54,399	2,159,640	11,180	443,846	221,478	166,551
1891	55,983	2,222,525	13,012	516,576	207,029	172,041
1892	72,893	2,893,852	13,431	533,211	207,215	154,398
1893	83,644	3,320,667	10,941	434,358	178,290	117,850
1894	138,077	5,481,657	13,980	555,006	245,697	136,608
1895	149,497	5,935,031	17,241	684,468	351,607	172,639
1896	208,500	8,277,450	(d)	(d)	(d)	(d)
1897	231,221	9,179,474	(d)	(d)	468,546	239,427
1898	280,764	11,146,331	(d)	(d)	(d)	(d)
1899	[e] 378,051	15,008,625	33,984	1,349,165	1,019,766	507,843
1900	558,585	22,175,825	52,323	2,077,223	....	....

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[a] This production of refined oil is not the whole amount of refined oil made in Japan, but is only that portion which is refined by those who produce crude oil and refine it themselves. Most of the crude oil goes into the hands of others, by whom it is refined, and as yet there are no means of ascertaining this quantity.

[b] 1 koku = 39.7 English gallons = 1.1 United States barrels.

[c] Value of yen on January 1, 1885, in United States money, 85.8 cents; 1886, 81 cents; 1887, 78.4 cents; 1888, 75.3 cents; 1889, 73.4 cents; 1890, 75.2 cents; 1891, 83.1 cents; 1892, 74.5 cents; 1893, 66.1 cents; 1894, 55.6 cents; 1895, 49.1 cents; 1896, 52.9 cents; 1897, 51.1 cents; 1898, 49.8 cents; 1899, 49.8 cents; 1900, 49.8 cents.

[d] Not ascertained.

[e] This represents the quantity of crude sold in 1899.

PRICES.

Current prices of petroleum in city of Tokyo, 1890 to 1899, inclusive.

[From official report of Japanese Government.]

Year.	Oil for burning, per koku.	Petroleum, per cask.
	Yen.	*Yen.*
1890	24.19	1.86
1891	23.25	1.67
1892	18.62	1.68
1893	22.10	1.75
1894	23.85	1.77
1895	27.08	2.23
1896	29.76	2.20
1897	32.72	2.10
1898	31.30	2.08
1899	35.04	2.84

1 koku=39.7 English gallons=1.14 United States barrels.
1 yen=50 cents.

INDIA.

RÉSUMÉ OF THE INDUSTRY.

There was a large increase in the production of crude petroleum in India during 1901, amounting to nearly 33 per cent as compared with 1900. This increase was secured in the Upper Burma field, which furnished over 96 per cent of the total production and which is located in the extreme eastern portion of India, northeast of the Irawadi River.

This field has been worked in a primitive manner by shafts for two hundred years. For many years the petroleum from this section was carted in earthern pots to the river and emptied into the holds of the native vessels, and then floated down in bulk to market.

Recent years have made many changes in the methods of operating, the modern rigs and wells taking the place of the original shafts. The modern methods reach strata that were far beyond the possible reach of the primitive methods.

The last three years have been a period of active development; a large amount of capital has been invested, attracted by the prospects of larger production brought about by the introduction of modern methods of producing, transporting, and refining the petroleum of this field. The production in 1901 was 1,430,716 barrels, valued at $994,123, as compared with 1,078,264 barrels, valued at $722,949 in 1900.

The geological horizon in which petroleum is found in this field is the upper Miocene beds, which is the same horizon that contains the petroleum at Boryslaw, Galicia. There are a series of loose sandstones, which always contain the petroleum, separated by argillaceous beds that act as a blanket to seal up the petroleum. The structure in this field reveals the existence of anticlinal and synclinal folds. The petroleum in the Yenongyoung district is found on the crest of an anticlinal of sharply sloping flanks, ranging from 35° to 40°, with a flat, dome-shaped axis.

In the early development of this field the specific gravity of the product of the deeper wells ranged from 0.8484 to 0.8750, equal to 35° to 30° Baumé. Petroleum taken from the more shallow wells was considerably heavier. The approximate composition of Burma petroleum, as determined by Mr. Fox, is illuminating petroleum, 50 per cent; lubricating petroleum, 40 per cent; paraffin wax, 10 per cent, which is certainly a remarkable showing for purity. The 10 per cent of paraffin wax quoted above probably contains 5 to 6 per cent of residuum. The other productive fields are Assam and Punjab, which are insignificant at present in the amount of their production compared to the Burma field. The probable amount of all of the grades of petroleum imported into India in 1901 is 80,000,000 gallons. Only 16,656,000 gallons were furnished by the United States, a much larger proportion being furnished by Russia. If the 50,000,000 gallons of crude petroleum produced in 1901 were converted into illuminating and lubricating products, they would probably yield 35,000,000 to 40,000,000 gallons, so that India must draw on other countries for two-thirds of her supply.

PRODUCTION.

The following table gives the production of petroleum in India from 1889 to 1901, in imperial gallons reduced to barrels of 42 gallons and in rupees reduced to dollars:

Production and value of petroleum in India from 1889 to 1901, inclusive.

Year.	Quantity.		Value.	
	Imperial gallons.	Barrels (42 United States gallons).	Rupees.	Dollars.
1889	3,298,737	94,250	....	....
1890	4,132,287	118,065	282,173	93,681
1891	6,654,570	190,131	362,792	132,782
1892	8,479,943	242,284	363,631	119,271
1893	10,463,908	298,969	771,112	225,165
1894	11,452,649	327,218	1,126,744	276,052
1895	13,003,748	371,536	1,539,231	332,474
1896	15,044,449	429,841	1,788,683	416,763
1897	19,099,648	545,704	2,257,842	508,014
1898	18,973,878	542,110	1,018,461	204,710
1899	32,934,007	940,971	1,885,259	388,363
1900	37,729,211	1,078,264	2,231,325	722,949
1901	50,075,117	1,430,716	3,068,283	994,123

The value of the rupee on January 1, 1890, in United States money was 33.2 cents; 1891, 36.6 cents; 1892, 32.8 cents; 1893, 29.2 cents; 1894, 24.5 cents; 1895, 21.6 cents; 1896, 23.3 cents; 1897, 22.5 cents; 1898, 20.1 cents; 1899, 20.6 cents; 1900, 32.4 cents; 1901, 32.4 cents.

PHILIPPINE ISLANDS.

PROSPECTS.

The existence of petroleum is known on most of the islands of this group. The workings are of the most primitive nature, carried on usually by the natives with appliances and substitutes that are surprising in their ingenuity—as is the patience necessary to accomplish the results.

Explorers are busy examining the conditions of the existence and the quality of the petroleum, and the probabilities are that in a few years the petroleum will be one of the articles of export, instead of being, as at present, almost entirely an article of import.

The islands of Panay, Leyte, Guimaras, Negros, Mindanao, and Cebu are known to contain petroleum. The large island of Mindanao produces some petroleum in the vicinity of Chattabatto. The island of Cebu has deposits of petroleum at Toledo, on the west coast, associated with coal and natural gas. On the island of Panay petroleum is reported at Janiway, in the province of Iloilo. The island of Leyte is said to have deposits of petroleum 4 miles from the town of Villaba, on the west coast.

The position of these islands would indicate the probable existence of petroleum, as Borneo, on the southwest, and Formosa and Japan, on the north, contain productive areas that are extensively operated.

CHINA.

CONSUMPTION AND SOURCES OF SUPPLY.

This vast Empire is a large consumer of refined petroleum, which, however, has declined during the year 1901 to 49,349,379 gallons from all sources, as compared with 83,580,024 gallons in 1900. This decline is due to the political disturbances in the interior, as the bulk petroleum fully maintained its record of former years, the decrease being in case oil; that is, oil in tin cases, in which condition it is shipped to the interior from the seaport cities. The great bulk of the refined petroleum exported into China comes from the United States, Russia, and Sumatra. For a number of years the quantities supplied by the two countries first named were pretty evenly balanced and amounted together to about 80 per cent of the total import, the remaining 20 per cent being supplied by Sumatra, which country has lately been increasing her proportion exported, since new fields of crude petroleum have been developed. There are indications that the importations of petroleum products from the United States are increasing more rapidly than those of Russia, owing to their superior quality.

DEPOSITS OF PETROLEUM, GAS, AND BRINE.

From the numerous accounts of travelers and explorers, there are, no doubt, large deposits of petroleum and natural gas in the interior of this great Empire, which have been determined incidentally in the development of salt brine. The wells in several salt brine regions are from 2,000 to 3,000 feet deep and have been in operation for many years. The process of drilling wells for salt brine, and the utilization of the natural gas and the petroleum developed, date back many centuries. The methods used in drilling these deep wells are most ingenious, when it is considered that the only iron or steel used is the bit and the fishing tools. Bamboo is used for rope, derrick, casing, and sand pump, the similarity of many of these appliances used for centuries to those in use to-day by the most advanced well drillers of America is remarkable.

AFRICA.

OIL INDICATIONS IN SOUTH AFRICA.

United States Consul-General Stowe, of Cape Town, under date of May 9, 1901, transmits a report from Mr. Seavill, of Kimberley, on the discovery of indications of mineral oil in South Africa, with reports on said indications by geological and mining experts, from which the following extracts have been taken:

The supposed oil belt in South Africa extends from the Ceres district across the country to Mossel Bay, on the coast, 250 miles east of Cape Town. The geological formation is the Devonian period throughout, locally known as the "Bokveldt beds." The most important oil fields of the Western Hemisphere belong to the Carboniferous and Devonian periods. The marked indications of the existence of petroleum in this belt are small quantities of gas escaping near the contact between the shales and sandstone; iridescent, oily-looking patches of film upon the surface of standing water near these contacts; mysterious fires occurring on the bare veldt, burning for two or three months at a time. In the Mossel Bay district another evidence of the existence of petroleum is found in the shape of a pitchy, bituminous substance between shales in the Gouritz River. The geological and physical character and condition of the rocks in the Mossel district are favorable. The shales of the Bokveldt series are compact and retentive in depth, while the sandstones and other beds of the table mountain sandstone which accompany the shales are well fitted by nature to act as reservoirs.

Two small companies have been formed recently for the purpose of securing prospective rights, and have obtained some 60,000 or 70,000 acres. A syndicate has also been formed at Kimberley, which has secured contracts covering about 200 farms in the Mossel Bay district, but beyond getting reports and putting down a 3-inch bore hole to 120 feet on Bailies Gat nothing has been done in the way of active prospecting. Neither the two Kimberley companies nor the Mossel Bay syndicate are in a financial position to carry on the work, nor are they at present able to secure the necessary capital for the purpose. The difficulties surrounding prospecting for petroleum in South Africa are very great, and may be stated as follows: First, the urgent want of experienced oil prospectors competent to decide authoritatively on oil formations and conditions, to locate proper spots for boring, and to conduct operations to any necessary depth; and second, the want of capital. The area of country showing indications is so great and the land so cheap that it might be worth the serious attention of Americans interested in the oil industry. There are no laws in Cape Colony referring to petroleum mining, and up to quite recently the Crown has claimed no rights whatever, but the surveyor-general has had such rights reserved in all recent issues of titles to Crown lands. The contracts made give the companies from three to five years' prospecting rights free of charge, with use of wood and water included. In the event of any payable mineral being found, a twenty-five-year lease to be granted to the concessionaires, without any premium, on a royalty of 5 per cent of the net profits. The contracts do not stipulate for work to be commenced within a stated time, and in most cases they give the option of the purchase of the farms outright for a moderate sum.

WORLD'S PRODUCTION.

The following table gives the production of all of the known countries that produce crude petroleum, together with the percentages of each for 1900 and 1901, in United States barrels, approximately:

World's production of petroleum in 1900 and 1901, by countries.

[Barrels of 42 gallons.]

Country.	1900.	Percentage of total.	1901.	Percentage of total.
United States	63,620,529	42.95	69,389,194	41.95
Canada	692,650	.47	704,872	.43
Peru	102,976	.07	72,261	.04
Russia	75,779,417	51.16	85,168,556	41.50
Galicia	2,346,505	1.58	3,251,544	1.97
Sumatra, Java, and Borneo	1,967,700	1.33	3,038,700	1.84
Roumania	1,628,535	1.10	1,406,160	.85
India	1,078,264	.73	1,430,716	.86
Japan	528,000	.36	600,000	.36
Germany	358,297	.24	313,630	.19
Italy	12,102	.01	10,100	.01
Total	148,114,975	100.00	165,385,733	100.00

The refined petroleum of all grades produced in the United States, Russia, and all other countries for the year 1901 is estimated to be very close to 1,500,000,000 gallons, divided as follows:

Total amount of refined petroleum produced in all countries in 1901.

[United States gallons.]

Country.	Gallons.	Per cent.
United States	911,120,944	60.7
Russia	414,122,990	27.7
All other countries (estimated)	174,756,066	11.6
Total	1,500,000,000	100.0

NATURAL GAS.

By F. H. Oliphant.

INTRODUCTION.

The consumption of natural gas has continued to increase, although the pressure, except in the new fields in West Virginia, has continued to decline, necessitating the expense of compression in order to market an increased production from the declining fields, which expense must continue to increase as the pressure declines and the distance to the source of supply increases.

During the year 1901 there was an unusual amount of consolidation of the older companies, and there were organized also a number of new companies with large capital, with a view, chiefly, of utilizing the great areas of high-pressure gas territory in Lewis, Harrison, Marion, and Wetzel counties of West Virginia by the construction of larger and longer pipe lines, so as to market this increased production in western Pennsylvania and Ohio. This involves the outlay of many millions of capital.

Natural gas is a luxury in the household which when once acquired is most difficult to dispense with. Consumers who have learned to know its value and convenience are very loath to part with it, and, even under the penalty of additional compensation to the producer, they prefer to retain it rather than go back to the grosser methods of heating by the use of wood or coal. In fact, outside of the areas supplied by natural gas the consumption of manufactured gas in the household has increased, although the substitutes offered are vastly inferior to natural gas in heating power and are at least double in cost per thousand feet.

These are the facts that have stimulated capitalists to invest the money necessary to develop the reservoirs of the natural-gas fields that are still holding their original pressure and volume. These capitalists are building hundreds of miles of larger lines in order to supply the towns and cities formerly supplied by nearer but now exhausted fields, and also to supply other cities that have never known the blessings of natural gas.

As a source of heat, light, and power natural gas is unexcelled from the moment it reaches the surface of the earth at the mouth of the well until it reaches the farthest consumer at the end of the pipe line. No preparation is necessary for its combustion, and no residue is left. It needs only to be mixed with the proper amount of air and to have the combustion started by a naked flame or by an electric spark, when it will appropriate to itself the proper amount of oxygen. As a source of heat it is unrivaled in the household, as it is also in the workshop in the generation of steam and in varied metallurgical operations; and as a source of light, even in its crude state, it will in many cases give a very fair illumination, which is much improved by the use of an argand burner and chimney. However, it remained for the Welsbach mantle, now in such universal use throughout the area supplied by natural gas, to produce from natural gas the most perfect and economical of lights.

As a source of power it stands at the head of the list for economy, both as to expense of installation and expense of operation. The natural-gas engine is used most extensively in the petroleum fields for pumping the petroleum to the surface in the thousands of small producing wells. In very many instances the flow of natural gas from the upper strata, above the petroleum-producing rock in the well, is sufficient to supply a gas engine to pump a cluster of from six to thirty wells.

It has been supplying the power for a very large number of factories and operations in the gas belt; and lately it has been extensively applied in creating the power by which the natural gas itself is compressed from a low to a high pressure when the original pressure has failed and the pipes are insufficient to deliver the necessary quantity of gas at the well pressure. A number of these compressors work up very close to 1,000 horsepower, with an economy that enables 8 to 10 cubic feet of natural gas to develop a horsepower for an hour, a saving of from 40 to 50 per cent over high-duty steam engines.

The State of West Virginia has for several years furnished an increasing quantity of natural gas to Pennsylvania and Ohio; yet there still remain under the domes and arches of its rugged hills great reservoirs of it that have only been sufficiently tested by the drill to prove their existence.

These reservoirs are being connected by additional lines of large pipe, and will shortly supply larger quantities to localities in these States that have exhausted their own nearer reservoirs, and now turn to West Virginia for a continuation of their supply.

The value of the natural gas sold in 1901 was greater than that of any previous year, though the quantity was greatly exceeded when it was first introduced extensively from about 1883 to the close of 1889. During this period of six years it was used in the most extravagant and reckless manner, and it was paid for at rates that were in many instances less than one-half the price of the equivalent coal. Large quantities were allowed to escape and burn from the mouths of hundreds of stand pipes from Saturday afternoon until Monday morning. It is highly probable that in these six years of reckless consumption four times the present production was consumed annually.

As the visible supply grew less the value became more apparent, and the appliances for consuming the gas became greatly improved after the introduction of the meter. The pipe-line companies greatly improved their methods, in securing better joints, in shutting off wells that were not needed to keep up the pressure in the mains, and in manipulating the wells themselves. By the extension of lines into newer territory they have been enabled to market increasing quantities at increased prices since the years 1895 and 1896, in each of which years only $13,000,000 worth of gas was sold.

The value of the natural gas consumed in the United States in 1901 was $27,067,500, which, at 15 cents per 1,000 cubic feet, is equivalent to 180,450,000,000 cubic feet. If it were possible to store this gas in a cube, the density throughout being equal, its sides would be 5,530 feet in length, or 250 feet greater than the sides of a cubic mile. If 20,000 cubic feet of natural gas be taken as equal to 1 ton of coal, 8,458,600 tons of coal, valued at $3.20 per ton, would be required to yield the sum of money for which the natural gas sold.

The value of the production for 1901 was greater than that of 1900 by $3,368,826, or over 14 per cent. It also exceeded that of 1899 by $6,992,627. It may also be interesting to note that the value of the 69,389,194 barrels of petroleum produced in the United States during 1901 was $66,417,335, and that the value of the natural gas amounted to 40.7 per cent of the value of the petroleum for the same year, and that, further, when the fuel value of the coal and wood displaced by natural gas in 1901—which amounts to $32,445,156—is considered, this estimated value of natural gas is nearly 49 per cent of the entire value of the crude petroleum produced in the same year.

There were 11,297 wells producing natural gas at the close of 1901, of which number 74 were not turned into the gas mains, and 2,088 producing wells were drilled in the same year; there were 453 dry holes, or nonproducers, and 1,084 were abandoned. In 1900 there were 10,293 producing wells, of which number 24 were shut in; 1,759 wells were drilled in the same year; 359 were dry holes, and 991 were abandoned. There were very nearly 800 miles of pipe laid during 1901, the mains varying from 2 inches up to 20 inches. This brought the total up to 21,848 miles of natural-gas mains of from 2 inches to 36 inches diameter in use at the close of 1901.

COMPRESSION OF NATURAL GAS.

The following table for ascertaining the compression of natural gas under different gage pressures is calculated on a pressure of 4 ounces to the square inch, the usual pressure at which it is marketed by many of the natural-gas companies. The atmospheric pressure is assumed to be 14.4 pounds to the square inch, and the temperature at which the table is calculated is 60° F. The quantity for any pressure greater than 4 ounces, or one-fourth of a pound, up to a pressure of 136 pounds, can be found by multiplying the reading of the meter by the figures opposite the pressure observed. The table contains the multipliers to be used in measuring the gas under pressures greater than 4 ounces to the square inch:

Multipliers to be used for natural gas which is measured at pressures greater than 4 ounces per square inch, atmospheric pressure being taken at 14.4 pounds per square inch.

Gage pressure.	Multiplier or density.	Gage pressure.	Multiplier or density.	Gage pressure.	Multiplier or density.	Gage pressure.	Multiplier or density.	Gage pressure.	Multiplier or density.
Pounds per sq. in.		*Pounds per sq. in.*		*Pounds per sq. in.*		*Pounds per sq. in.*		*Pounds per sq. in.*	
0	0.98294	24	2.66118	48½	4.29365	73	5.96576	97½	7.63883
¼	1.00000	24½	2.65531	49	4.32778	73½	5.99989	98	7.67296
½	1.01706	25	2.68944	49½	4.36191	74	6.03402	98½	7.70709
1	1.05119	25½	2.72357	50	4.39604	74½	6.06815	99	7.74122
1½	1.08532	26	2.75770	50½	4.43017	75	6.10228	99½	7.77535
2	1.11945	26½	2.79183	51	4.46424	75½	6.13641	100	7.80948
2½	1.15358	27	2.82596	51½	4.49834	76	6.17054	100½	7.84361
3	1.18771	27½	2.86009	52	4.53250	76½	6.20467	101	7.87774
3½	1.22184	28	2.89422	52½	4.56663	77	6.23880	101½	7.91187
4	1.25597	28½	2.92835	53	4.60076	77½	6.27293	102	7.94600
4½	1.29010	29	2.96248	53½	4.63489	78	6.30706	102½	7.98013
5	1.32423	29½	2.99661	54	4.66902	78½	6.34119	103	8.01426
5½	1.35836	30	3.03074	54½	4.70315	79	6.37532	103½	8.04839
6	1.39249	30½	3.06487	55	4.73728	79½	6.40945	104	8.08252
6½	1.42662	31	3.09900	55½	4.77141	80	6.44358	105	8.15078
7	1.46075	31½	3.13313	56	4.80554	80½	6.47761	106	8.21904
7½	1.49488	32	3.16726	56½	4.83967	81	6.51174	107	8.28730
8	1.52901	32½	3.20139	57	4.87380	81½	6.54587	108	8.35556
8½	1.56315	33	3.23552	57½	4.90793	82	6.58000	109	8.42382
9	1.59728	33½	3.26965	58	4.94206	82½	6.61503	110	8.49208
9½	1.63141	34	3.30378	58½	4.97619	83	6.64916	111	8.56034
10	1.66554	34½	3.33791	59	5.01032	83½	6.68329	112	8.62860
10½	1.69967	35	3.37204	59½	5.04445	84	6.71732	113	8.69686
11	1.73380	35½	3.40617	60	5.07858	84½	6.75145	114	8.76512
11½	1.76793	36	3.44030	60½	5.11271	85	6.78558	115	8.83338
12	1.80206	36½	3.47443	61	5.14684	85½	6.81971	116	8.90164
12½	1.83619	37	3.50856	61½	5.18097	86	6.85384	117	8.96990
13	1.87032	37½	3.54269	62	5.21510	86½	6.88797	118	9.03816
13½	1.90445	38	3.57682	62½	5.24913	87	6.92210	119	9.10624
14	1.93858	38½	3.61095	63	5.28326	87½	6.95623	120	9.17468
14½	1.97371	39	3.64508	63½	5.31739	88	6.99036	121	9.24294
15	2.00684	39½	3.67921	64	5.35152	88½	7.02449	122	9.31120
15½	2.04097	40	3.71334	64½	5.38565	89	7.05862	123	9.37946
16	2.07510	40½	3.74747	65	5.41978	89½	7.09275	124	9.44772
16½	2.10923	41	3.78160	65½	5.45391	90	7.12788	125	9.51598
17	2.14336	41½	3.81573	66	5.48804	90½	7.16101	126	9.58424
17½	2.17749	42	3.84986	66½	5.52217	91	7.19514	127	9.65250
18	2.21162	42½	3.88399	67	5.55630	91½	7.22927	128	9.72076
18½	2.24575	43	3.91812	67½	5.59043	92	7.26340	129	9.78902
19	2.27988	43½	3.95225	68	5.62456	92½	7.29753	130	9.85728
19½	2.31401	44	3.98638	68½	5.65869	93	7.33166	131	9.92554
20	2.34814	44½	4.02051	69	5.69282	93½	7.36579	132	9.99380
20½	2.38227	45	4.05464	69½	5.72695	94	7.39992	133	10.06206
21	2.41640	45½	4.08887	70	5.76108	94½	7.43405	134	10.13032
21½	2.45053	46	4.12300	70½	5.79521	95	7.46818	135	10.19858
22	2.48466	46½	4.15713	71	5.82934	95½	7.50231	136	10.26680
22½	2.51879	47	4.19126	71½	5.86347	96	7.53644		
23	2.55292	47½	4.22539	72	5.89750	96½	7.57057		
23½	2.58705	48	4.25952	72½	5.93163	97	7.60470		

VALUE OF NATURAL-GAS PRODUCTION.

In the following table is given the approximate value of natural gas produced in the United States from 1889 to 1901, by States:

Approximate value of natural gas produced in the United States from 1889 to 1901, inclusive, by States.

State.	1889.	1890.	1891.	1892.	1893.	1894.	1895.
Arkansas	$375	[a] $6,000	$250	$100	$100	$100	$100
California	12,680	33,000	30,000	55,000	62,000	60,350	55,000
Colorado	....	....	....	....	....	12,000	7,000
Illinois	10,615	6,000	6,000	12,988	14,000	15,000	7,500
Indiana	2,075,702	2,302,500	3,942,500	4,716,000	5,718,000	5,437,000	5,203,200
Kansas	15,873	12,000	5,500	40,795	50,000	86,600	112,400
Kentucky	2,580	30,000	38,993	43,175	68,500	89,200	98,700
Missouri	35,687	10,500	1,500	3,775	2,100	4,500	3,500
New York	530,026	552,000	280,000	216,000	210,000	249,000	241,530
Ohio	5,215,669	4,684,300	3,076 325	2,136,000	1,510,000	1,276,100	1,255,700
Pennsylvania	11,593,989	9,551,025	7,834,016	7,376,281	6,488,000	6,279,000	5,852,000
South Dakota	25	([a])	....	....	....	....	....
Texas	1,728	([a])	....	100	50	50	20
Utah	150	([a])	....	....	500	500	20,000
West Virginia	12,000	5,400	35,000	500	123,000	395,000	100,000
Other States	1,600,000	1,600,000	250,000	200,000	100,000	50,000	50,000
Total	21,107,099	18,792,725	15,500,084	14,800,714	14,346,250	[b]13,954,400	[b]13,006,650

State.	1896.	1897.	1898.	1899.	1900.	1901.
Arkansas	$60	$40	....	....	....	....
California	55,682	50,000	$65,337	$86,891	$79,083	$67,602
Colorado	4,500	4,000	3,300	1,480	1,800	1,800
Illinois	6,375	5,000	2,498	2,067	1,700	1,825
Indiana	5,043,635	5,009,208	5,060,969	6,680,370	7,254,539	6,954,566
Kansas	124,750	105,700	174,640	332,592	356,900	659,173
Kentucky	99,000	90,000	103,133	125,745	286,243	270,871
Missouri	1,500	500	145	290	547	1,328
New York	256,000	200,076	229,078	294,593	335,367	293,232
Ohio	1,172,400	1,171,777	1,488,308	1,866,271	2,178,234	2,147,215
Pennsylvania	5,528,610	6,242,543	6,806,742	8,337,210	10,215,412	12,688,161
South Dakota	....	....	....	3,500	9,817	7,255
Texas	....	....	765	8,000	20,000	20,000
Utah	20,000	15,050	7,875	....	....	....
West Virginia	640,000	912,528	1,334,023	2,335,864	2,959,032	3,954,472
Other States	50,000	20,000	20,000	....	....	....
Total	[b] 13,002,512	[b] 13,826,422	[b] 15,296,813	[b] 20,074,873	[b] 23,698,674	[b] 27,067,500

[a] Includes value of gas produced in South Dakota, Texas, and Utah, $6,000.
[b] Does not include value of gas produced in Canada and consumed in the United States.

The above table is conspicuous for the value of the natural gas sold during 1901, the increase being $3,368,826, as compared with the value in 1900. This increase is due principally to increased production, the increase in the general price being very slight, and is not due so much to the output from the recently developed fields in southwestern Pennsylvania and central West Virginia as to the enlarging of lines and the installation of gas compressors. It is this that has kept up the quantity marketed in Indiana to about the average of former years, although the rock pressure has very largely decreased. Kansas, however, has increased the value of natural gas marketed both by developing new territory and by exploiting more thoroughly that which was already known. The value of the gas produced in each State is credited to it, although Pennsylvania furnished natural gas to Ohio, New York, and West Virginia; West Virginia furnished gas to Pennsylvania and Ohio; Indiana furnished gas to Ohio and Illinois, and Kentucky furnished gas to Ohio and West Virginia. These complications require a careful tabulation of the values, so that each State shall receive its proper credit.

Notwithstanding all the care exercised in the collection and distribution of the statistics, there is a very considerable amount of natural gas consumed of which no account is rendered, as it is used universally in the oil fields for pumping wells, both in the gas engine and under the boilers; for driving gas compressors, for supplying farmhouses, and many operations in the field. There are instances, which reach from northern central New York to eastern Illinois, where single wells supply one or two houses, so that if it were possible to secure a complete return of the value of all the fuel displaced, the figures presented would be increased by at least 10 per cent.

It is estimated that fully 1,000,000 domestic fires are supplied by natural gas, and that 4,000,000 people are furnished with this ideal fuel and light to gladden their homes.

AMOUNT AND VALUE OF NATURAL GAS CONSUMED.

The following table gives the amount of natural gas consumed in each State as reported by 1,545 companies and individuals, and the value of the coal and wood or other fuel displaced by the gas.

There was a considerable increase in the value of the natural gas consumed in Pennsylvania, a slight increase in Ohio, and a large increase in West Virginia and Kansas, as shown in the second column. The third column shows the estimated value of the coal, wood, and other fuel displaced, amounting to $32,445,156, which if divided by the 8,458,600 tons of coal, would give an average value of $3.84 per ton instead of $3.20 per ton, the estimated value given on a previous page. This discrepancy is due to the low price received for natural gas in the State of Indiana, which was only about 60 per cent of the value of the fuel displaced. Kansas also shows a much less value for the natural gas than for the fuel displaced.

Value of natural gas consumed in the United States in 1901, by States, and the value of coal or wood displaced by same, as reported by 1,545 persons, firms, and corporations.

State.	Companies or individuals reporting.	Amount received for sale of gas or value of gas consumed.	Estimated value of coal, wood, or other fuel displaced by gas.
Pennsylvania	296	$11,785,996	$11,892,070
Indiana	656	6,276,119	10,669,402
Ohio	305	4,119,059	4,448,584
West Virginia	44	2,244,758	2,415,360
New York	114	1,694,925	1,655,942
Kansas	48	659,173	995,350
Kentucky	26	187,660	206,426
California	12	67,602	122,064
Texas	2	20,000	20,000
South Dakota	3	7,255	15,005
Illinois	22	1,825	1,825
Colorado	2	1,800	1,800
Missouri	15	1,328	1,328
Total	1,545	27,067,500	32,445,156

In the following table is given the value of natural gas consumed in the United States in 1899, 1900, and 1901, by States:

Value of natural gas consumed in the United States in 1899, 1900, and 1901, by States.

State.	1899.	1900.	1901.
Pennsylvania	$7,926,970	$9,812,615	$11,785,996
Indiana	[a] 5,833,370	[a] 6,412,307	[a] 6,276,119
Ohio	3,207,286	3,823,209	4,119,059
West Virginia	1,310,675	1,530,378	2,244,758
New York	1,236,007	1,456,286	1,694,925
Kansas	332,592	356,900	659,173
Kentucky	125,745	194,032	187,660
California	86,891	79,083	67,602
Texas	8,000	20,000	20,000
South Dakota	3,500	9,817	7,255
Illinois	2,067	1,700	1,825
Colorado	1,480	1,800	1,800
Missouri	290	547	1,328
Total	20,074,873	23,698,674	27,067,500

[a] Portion of this was consumed in Chicago, Ill.

By comparing this table with the first one, giving the approximate value of the natural gas produced in the several States, it will be noticed that Pennsylvania produced nearly $1,000,000 worth more than was consumed within the State. Indiana, as has been stated, supplied large quantities to Chicago and some to Ohio; West Virginia supplied large quantities of natural gas to Pennsylvania and Ohio, and Kentucky furnished gas to Ohio and West Virginia. This accounts for the rearrangement of the figures whose totals are the same.

USES OF NATURAL GAS.

In the following table are specified the uses to which the natural gas produced in the United States in 1901 was put:

Uses to which natural gas produced in the United States in 1901 was put, as reported by 1,545 persons, firms, and corporations.

State.	Companies or individuals reporting.	Domestic fires supplied.	Establishments supplied.				
			Iron mills.	Steel works.	Glass works.	Other establishments.	Total.
Pennsylvania	296	326,912	[a]82	....	80	1,581	1,743
Indiana	656	153,869	11	....	111	2,448	2,570
Ohio	305	49,709	5	1	13	930	949
West Virginia	44	55,808	2	....	13	251	266
New York	114	95,161	....	....	2	96	98
Kansas	48	10,227	....	....	....	72	72
Kentucky	26	16,420	....	1	....	19	20
California	12	1,438	....	....	....	7	7
Texas	2	180	....	....	....	9	9
South Dakota	3	93	....	....	....	8	8
Illinois	22	73	....	....	....	....	....
Colorado	2	....	....	....	....	....	....
Missouri	15	31	....	....	....	....	....
Total	1,545	709,921	[a]100	2	219	5,421	5,742

[a] Includes steel works in Pennsylvania.

RECORD OF WELLS AND PIPE LINES, BY STATES.

In the following table will be found the number of companies and individuals reporting, the producing wells at the close of 1900 and 1901, the producing wells drilled, and the nonproducing or dry holes drilled in 1901, together with the total length of pipe in use at the close of 1901, by States.

Record of wells and amount of pipe line, as reported by 1,545 persons, firms, and corporations in 1901, by States.

State.	Companies or individuals reporting.	Wells.					Total pipe laid to Dec. 31, 1901.	
		Producing, Dec. 31, 1900.	Producing, drilled in 1901.	Abandoned in 1901.	Producing, Dec. 31, 1901.	Nonproducing holes drilled in 1901.	Feet.	Miles.
Pennsylvania	296	3,776	660	239	4,197	143	47,913,618	9,074.55
Indiana	656	4,287	985	700	4,572	208	31,241,320	5,916.92
Ohio	305	885	113	48	950	35	15,199,295	2,878.65
West Virginia	44	418	177	51	544	8	11,852,303	2,244.75
New York	114	535	53	8	580	14	5,785,038	1,095.65
Kansas	48	213	71	28	256	35	2,425,410	459.36
Kentucky	26	101	13	5	109	4	631,535	119.61
California	12	23	4	....	27	....	163,450	30.96
Texas	2	13	6	4	15	1	92,696	17.56
South Dakota	3	3	1	....	4	....	26,800	5.08
Illinois	22	25	2	....	27	5	12,000	2.27
Colorado[a]	2	....	....	....	....	....	12,000	2.27
Missouri	15	14	3	1	16	....	2,825	.53
Total	1,545	[b]10,293	2,088	1,084	[b]11,297	453	115,358,290	21,848.16

[a] Gas from oil wells.

[b] Includes 74 wells not utilized in 1901.

There were 1,004 more producing wells at the close of 1901 than at the close of 1900, also 50 more wells held in reserve. There were 329 more wells drilled, 93 more wells abandoned, and 94 more dry holes developed in 1901 than in 1900.

The increase in new mains or pipe line laid in 1901 over the pipe line in use at the close of 1900 was 799.79 miles. The greater portion of this increase was in Pennsylvania, West Virginia, and Kansas. In Indiana 514 miles were taken up and used elsewhere.

COMPARISON OF COMPANIES MAKING COMPLETE RETURNS.

In the following table will be found some interesting statistics of the value of the natural gas produced in Pennsylvania, Ohio, and Indiana, for 1900 and 1901. Since the same companies made complete returns for both years, the table is of special value for purposes of comparison. It will be noticed that the value of natural gas sold in Pennsylvania increased $1,617,383 in 1901 over 1900. In Indiana there was a slight decrease and in Ohio a slight increase in 1901 as compared with 1900. While the value of the fuel displaced by natural gas in Pennsylvania and Ohio was slightly greater than the value of the natural gas, in Indiana it was very much greater, owing to the very low prices received for natural gas in that State; however, the last year has witnessed an increase in the price, although less was sold, and the differences, though still great, are gradually approaching each other. Indiana has very nearly the same number of producing wells as Pennsylvania and nearly eight times as many as Ohio, and there were more wells drilled in Indiana in 1901 than there were in 1900, and also more abandoned. The number of domestic fires reported by these companies show a considerable increase in all of the States, there being evidently a tendency to increase the domestic consumption.

The figures in this table are not the complete returns, but the returns of those companies that have answered fully all. of the questions of inquiry during 1900 and 1901, and are therefore capable of being compared. However, they represent a very large proportional value, over 80 per cent. of the natural gas marketed in those three States.

Natural-gas records in 1900 and 1901 of companies in Pennsylvania, Indiana, and Ohio making complete returns.

	Pensylvania.		Indiana.		Ohio.	
	1900	1901	1900	1901	1900	1901
Amount received for sale of gas or value of gas consumed	$9,181,210	$10,798,593	$5,241,192	$5,178,765	$2,301,644	$2,570,148
Value of coal or wood displaced	$9,159,175	$10,895,780	$9,696,205	$8,803,901	$2,146,283	$2,775,760
Domestic fires supplied	224,847	317,882	119,640	123,877	105,152	123,896
Iron and steel works supplied	54	74	9	4	6	2
Glass works supplied	75	72	67	72	9	8
Other establishments supplied	1,138	1,463	2,350	2,305	807	756
Total establishments supplied	1,267	1,609	2,426	2,381	822	766
Total wells producing Jan. 1.	2,859	3,136	3,017	3,193	423	133
Total producing wells drilled	485	475	745	802	61	64
Total wells abandoned	207	183	569	604	51	27
Total wells producing Dec. 31	3,137	3,429	3,193	3,391	433	170
Total dry holes drilled	136	121	122	191	15	19
Total feet of pipe laid	40,935,847	42,393,831	26,385,022	23,232,199	11,295,856	11.579,061
Total establishments reporting	144	144	438	438	76	76

RECORD BY STATES.

PENNSYLVANIA.

The deep sand gas territory in southwestern Pennsylvania and the use of gas compressors throughout the different fields brought about an increase in the production of natural gas in this State in 1901 over that of 1900 amounting to $2,472,749, as compared with an increase of $1,878,202 in 1900 over the production of 1899. The price advanced slightly over that of the previous year, but the increase is due almost entirely to the increased quantity marketed. Pennsylvania produced

$12,688,161 worth of natural gas in 1901, and consumed $11,785,996 worth, producing $902,165 worth more than was consumed. This State supplied large quantities to New York, Ohio, and a smaller amount to West Virginia. On the other hand, it received large quantities from West Virginia, but not enough to make good the quantity supplied by it to other States. Pennsylvania produced almost as much natural gas in value as Ohio, Indiana, and West Virginia combined, or about 45 per cent of the whole. There were 4,197 producing wells and 660 drilling wells in the State at the close of 1901; and there were also 239 wells abandoned and 143 dry holes completed in 1901, as compared with 3,776 producing wells, 210 abandoned wells, and 142 dry holes for the year 1900.

Value of natural gas produced in Pennsylvania from 1885 to 1901, inclusive.

Year.	Value.	Year.	Value.
1885	$4,500,000	1894	$6,279,000
1886	9,000,000	1895	5,852,000
1887	13,749,500	1896	5,528,610
1888	19,282,375	1897	6,242,543
1889	11,593,989	1898	6,806,742
1890	9,551,025	1899	8,337,210
1891	7,834,016	1900	10,215,412
1892	7,376,281	1901	12,688,161
1893	6,488,000		

INDIANA.

In the following table will be found a statement of the value of the natural gas produced in Indiana from 1886 to 1901:

Value of natural gas produced in Indiana from 1886 to 1901, inclusive.

Year.	Value.	Year.	Value.
1886	$300,000	1894	$5,437,000
1887	600,000	1895	5,203,200
1888	1,320,000	1896	5,043,635
1889	2,075,702	1897	5,009,208
1890	2,302,500	1898	5,060,969
1891	3,942,500	1899	6,680,370
1892	4,716,000	1900	7,254,539
1893	5,718,000	1901	6,954,566

The value of the natural gas produced in Indiana during 1901 was $6,954,566, a decrease of $299,973. This is a remarkable record when the decrease in pressure and the exhaustion over the entire field amounted to an average of about 80 pounds at the close of 1901, leaving but 25 per cent of the original quantity packed in the Trenton limestone over an area of about 2,850 square miles.

The decrease of pressure has caused the salt water to invade the gas strata over large areas. The practice of allowing large quantities of gas to escape from the upper portion of the strata so that the petroleum can be secured from the lower portion has been the source of considerable waste, which would have been much greater had not the legislature of the State passed stringent laws prohibiting it.

It is remarkable that with the declining pressure there is not a much greater decline in the quantity marketed, and that many of the wells connected with gas-pumping plants continue to produce when the pressure is reduced to a few pounds, or even below that of the atmosphere.

It is due to the gas compressors that the quantity is maintained. Many of these are arranged to draw the gas into large pumps at low pressure and to discharge it into other smaller pumps, where additional pressure is put upon it. At this rate a few years more, possibly two or three, will see a very large reduction in the production, probably 60 or 80 per cent, and very many individuals and manufacturers that have known the benefits of this most precious fuel will be forced with regret to resort to other methods of heat and light. No other State has parted with this precious fuel for so little compensation. The statistics show that the money received from the sale of natural gas was not over 60 per cent of the value of other fuel, and that the value of the fuel consumed was nearly 81 per cent of the value of that consumed in Pennsylvania. The quantity, therefore, of natural gas consumed in Indiana for a number of years past must be fully as large as that consumed in Pennsylvania, although only about 55 per cent of the value received in Pennsylvania was received in Indiana.

For several years Indiana has furnished a large amount of natural gas to Chicago, approximately 20,000,000 cubic feet per day.

There were 4,572 producing wells in Indiana at the close of 1901, as compared with 4,287 at the close of 1900. There were 985 gas wells drilled as well as 208 dry holes completed during 1901. There were 656 individuals and companies that produced gas in Indiana, more than double the number in Ohio and Pennsylvania; and there were 597 miles less pipe in Indiana at the close of 1901 than at the close of 1900.

To show the great reduction in pressure in one of the best territories of the State, Grant County, the following report of tests, made by one of the leading producers in the State of Indiana, is given:

> The tests were made in August, 1901, so as to make provision for the winter. The last well was drilled in November, 1900, 6 miles southeast of Gas City, as the crow flies, within a mile of being halfway between Gas City and Hartford City, which is 6 miles due east of the well. Here, taking the mid-distance as a center, within a radius of 4 miles is the best territory in the State of Indiana. This well showed in

November, 1900, when drilled, a pressure (with correct gauge) of 182 pounds, and on August 28, 1901, it tested 142 pounds, having lost in pressure 40 pounds in ten months. The well when drilled was dry. It was drilled 28½ feet in Trenton rock, and showed a volume by Pitot tube of 1,851,880 cubic feet. August 28, 1901, the well was wet and a correct test was not obtained, but from experience a flow of 1,200,000 cubic feet was estimated.

Another well three-fourths of a mile west and a trifle south of the one described, drilled on July 30, 1899, has the following record:

Date.	Rock pressure.	Volume in 24 hours.
	Pounds.	*Cubic feet.*
July 30, 1899	215	2,623,212
August 8, 1900	190	2,208,500
August 28, 1901	145	1,661,100

The last named is our best well, being in a territory that is not drawn from heavily, and it is a good test of the best territory in the State. The pressure of this well is now (February 6, 1902) probably 120 pounds, and will diminish rapidly next fall, as the territory has not the pressure to resist the water.

WEST VIRGINIA.

This State is the hope of the future for the continued supply of gas fuel to Pennsylvania and Ohio. Its rock-bound reservoirs lie deeply buried in the folds of strata over many square miles that have recently been proved, by wells of remarkable volume and pressure, to contain great reservoirs of this most precious fuel.

During the last year Lewis, Harrison, Marion, Monongalia, and Wetzel counties have produced some remarkable wells from the Gordon sand, the Stray sand, the Fifth, and the Elizabeth or Bayard sands, which are from 2,700 to 3,200 feet in depth, and have a volume of from 10,000,000 to 15,000,000 cubic feet in twenty-four hours and a rock pressure of from 1,000 to 1,300 pounds per square inch. The other counties that have more or less natural gas are Tyler, Ritchie, Doddridge, Marshall, Wood, Wirt, Roane, Calhoun, Boone, Mingo, Kanawha, Logan, and Gilmer.

A number of the largest natural-gas companies in western Pennsylvania get more or less of their supply from West Virginia, and as there are several of them extending their lines farther south, as well as enlarging them, the indications are that the years to come will see very large quantities of natural gas supplied by this State to Pennsylvania and Ohio. There is more natural gas consumed uncredited in this State in the development of the petroleum than in any other. For this gas it was impossible to get full or even partial returns.

The value of the natural gas produced in West Virginia from 1889 to 1901 is shown in the following table:

Value of natural gas produced in West Virginia from 1889 to 1901, inclusive.

Year.	Value.	Year.	Value.
1889	$12,000	1896	$640,000
1890	5,400	1897	912,528
1891	35,000	1898	1,334,023
1892	500	1899	2,335,864
1893	123,000	1900	2,959,032
1894	395,000	1901	3,954,472
1895	100,000		

OHIO.

This State received very little gas from the original Trenton rock fields during the year 1901, the pressure having been reduced over a large area of about 500 square miles to practically nothing, where it originally registered 425 pounds. The failing supply from the original field was partially made up from the Sugar Grove field, 150 miles to the southwest. A number of additional towns were supplied from this field during the last two years, and this has caused a great reduction in its pressure, which has declined from 750 pounds to the square inch until the average pressure was less than 160 pounds at the close of 1901, although there was an average pressure of 350 pounds at the close of 1900. This shows the immense drain on this pool, which must have supplied over $1,500,000 of the total $2,147,215 produced during the year 1901. There was a new pool of natural gas developed in Morgan Township, Knox County, from the same horizon as that found in the Sugar Grove field. There are a number of natural-gas pools in Guernsey, Belmont, Noble, and Perry counties, which get their gas from the Berea sand, and supply the towns of Cambridge, Corning, New Lexington, and numerous other small places.

In Ashtabula County a number of small gas wells have been secured from the Corniferous limestone, which have lately been piped to Ashtabula and Jefferson. West Virginia, however, continued to furnish a large quantity of natural gas to Ohio, supplying Marietta, Belpre, Newport, New Matamoras, Sardis, Powhatan, Dennison, Urichville, Canal Dover, Canton, Massillon, Akron, and in part Steubenville, East Liverpool, Toronto, Bridgeport, Mingo, and Wellsville. The indications are that a much larger quantity will be delivered to Ohio from West Virginia in the future. Indiana and Pennsylvania also furnished a decreasing amount during 1901.

The value of the natural gas produced in Ohio from 1885 to 1901 is shown in the following table:

Value of natural gas produced in Ohio from 1885 to 1901, inclusive.

Year.	Value.	Year.	Value.
1885	$100,000	1894	$1,276,100
1886	400,000	1895	1,255,700
1887	1,000,000	1896	1,172,400
1888	1,500,000	1897	1,171,777
1889	5,215,669	1898	1,488,308
1890	4,684,300	1899	1,866,271
1891	3,076,325	1900	2,178,234
1892	2,136,000	1901	2,147,215
1893	1,510,000		

Since the year 1897, it will be noticed, there has been a gradual increase in the production of natural gas in Ohio, the year 1901 showing a very slight decrease. The value of the gas consumed, however, as shown by a previous table, was $4,119,059, so that practically over 52 per cent was furnished by West Virginia, Indiana, and Pennsylvania.

NEW YORK.

Natural gas is found over a very large area in the western portion of New York in a number of different sands and limestones, including the Devonian black slate, the Bradford sand, and the underlying Kane and Elk sands, the Corniferous limestone, the Medina sandstone, the Trenton limestone, and the Upper Calciferous. The greater portion of the gas comes from the neighborhood of Wellsville and Ricebrook, in Allegany County, from the sands found in the Upper Devonian. There are a vast number of wells scattered along the south shore of Lake Ontario that furnish from one to four families with gas. The greater portion of the natural gas consumed in the State comes from Pennsylvania, the largest consumption being in the city of Buffalo. The town of Fredonia used natural gas as far back as 1821 from natural flows and shallow wells, and has the honor of first making use of it as a source of light and heat. The counties producing natural gas are Allegany, Cattaraugus, Erie, Livingston, Niagara, Onondaga, Ontario, Oswego, Seneca, and Steuben. The value of the natural gas produced in 1901 was $293,232, being a considerable decrease as compared with the year previous, while the value of the amount consumed was $1,694,925, showing that only about 18 per cent is produced in the State. The number of wells producing at the close of 1901 was 580, as compared with 535 at the close of 1900. There were 1,096 miles of natural-gas mains from 2 inches and over in use at the close of 1901.

The value of natural gas produced in New York from 1885 to 1901 is given in the following table:

Value of natural gas produced in New York from 1885 to 1901, inclusive.

Year.	Value.	Year.	Value.
1885	$196,000	1894	$249,000
1886	210,000	1895	241,530
1887	333,000	1896	[a] 256,000
1888	332,500	1897	200,076
1889	530,026	1898	229,078
1890	552,000	1899	294,593
1891	280,000	1900	335,367
1892	216,000	1901	293,232
1893	210,000		

[a] A portion of this amount should be credited to Pennsylvania, but it was impossible to make the separation.

KANSAS.

No other State increased as largely in the production of natural gas as Kansas during 1901, and southeastern Kansas seems awakening to the fact that it has buried under its fertile, gently undulating surface reservoirs of the most valuable fuel, and is capable of furnishing large quantities to private consumers and manufacturers at prices that will attract outside capital as well as enable the native products to be profitably worked. Already the towns of Neodesha, Coffeyville, Cherryvale, Iola, Independence, Chanute, Paola, Parsons, and Osawatomie and numerous villages have a regular supply.

It is used largely in the smelting of zinc, in brick manufactories, in hydraulic cement manufactories, and in many other smaller manufactories where power is required. The very low price at which this fuel is sold reduces the amount received for it far below the value of the other fuels displaced, as it is shown in a previous table that the value of the fuels displaced by natural gas was $995,350, while the amount received was only $659,173.

The value of the natural gas produced in Kansas from 1889 to 1901 has been as follows:

Value of natural gas produced in Kansas from 1889 to 1901, inclusive.

Year.	Value.	Year.	Value.
1889	$15,873	1896	$124,750
1890	12,000	1897	105,700
1891	5,500	1898	174,640
1892	40,795	1899	332,592
1893	50,000	1900	356,900
1894	86,600	1901	659,173
1895	112,400		

From the above table it will be seen that in 1901 the value increased more than 55 per cent over that of 1900. There were 256 producing wells at the close of 1901, as compared with 213 wells at the close of 1900. The capacities of these wells range from 200,000 to 8,000,000 cubic feet in twenty-four hours. The largest wells thus far found are in Neosho, Allen, and Montgomery counties.

KENTUCKY.

The principal gas area thus far developed is in eastern Kentucky, in Martin County. There are some fair gas wells in western Floyd County. Ashland, Catlettsburg, and Louisa are supplied from this region. In Meade County there is still found some shale gas, which is conveyed to Louisville. During the fall of 1901 a large gas well was developed near the Beaver oil pool in Wayne County. There is also a fair gas well over the State line in Fentress County, Tenn. There is a small supply of gas obtained for domestic use in Breckinridge County, in the vicinity of Cloversfoot, also in Hardin and Jefferson counties.

There was a slightly decreased amount of natural gas sold in this State in 1901 as compared with the previous year. A considerable quantity was consumed in West Virginia and Ohio, which was supplied by Kentucky. The value of the natural gas produced during 1901 was $270,871, and of this amount $187,660 was marketed in the State. The value of other fuel displaced for the same year was $206,426. There were 109 producing wells at the close of 1901, as compared with 101 producing at the close of 1900.

The value of the natural gas produced in Kentucky from 1889 to 1901 is shown in the following table:

Value of natural gas produced in Kentucky from 1889 to 1901, inclusive.

Year.	Value.	Year.	Value.
1889	$2,580	1896	$99,000
1890	30,000	1897	90,000
1891	38,993	1898	103,133
1892	43,175	1899	125,745
1893	68,500	1900	286,243
1894	89,200	1901	270,871
1895	98,700		

CALIFORNIA.

Although there are numerous small gas wells in this State, by far the greatest production comes from wells at the city of Stockton, in the great San Joaquin Valley. It is also found near the city of Sacramento, in the Sacramento Valley, in Tulare County, near Tulare Lake, and in Tehama County. To a small extent it is produced by a few wells at the city of Los Angeles. In the two former instances it is associated with artesian-water flows. At Stockton the wells are 2,000 feet deep, yet none of them has passed through the alluvial deposit into the solid stratified measures. Under the pressure of 2,000 feet, water will absorb a large amount of gas, which is gradually liberated as it ascends in the well and the pressure diminishes. Ten of these wells at Stockton yield about 30,000 cubic feet of natural gas a day. It is questionable whether the flow of most of the water from artesian wells is not due to gas pressure rather than to artesian head in a porous stratum, to which it is generally credited.

The value of the natural gas produced in California from 1889 to 1901 is shown in the following table:

Value of natural gas produced in California from 1889 to 1901, inclusive.

Year.	Value.	Year.	Value.
1889	$12,680	1896	$55,682
1890	33,000	1897	50,000
1891	30,000	1898	65,337
1892	55,000	1899	86,891
1893	62,000	1900	79,083
1894	60,350	1901	67,602
1895	55,000		

There were 27 wells producing more or less gas and water at the close of 1901, as compared with 23 at the close of 1900. During 1901 4 wells were drilled and nearly 31 miles of main pipe line were in use.

UTAH.

No natural gas has been produced in this State for three years. The wells, 12 miles north of Salt Lake City, have become choked up by the decomposition of the slate forming the walls of the gas wells.

The value of natural gas produced in Utah from 1893 to 1901 has been as follows:

Value of natural gas produced in Utah from 1893 to 1901, inclusive.

Year.	Value.	Year.	Value.
1893	$500	1898	$7,875
1894	500	1899	0
1895	20,000	1900	0
1896	20,000	1901	0
1897	15,050		

TEXAS.

Some wonderful pockets of high-pressure gas have been developed in the Beaumont field, which blew up bowlders and sand mixed with water and traces of petroleum. The gas strata were usually developed about 200 feet above the oil pay. When the pressure was confined it developed 250 pounds to the square inch, and, after the gas originally in the rock had been exhausted, the gas under pressure was used to assist the petroleum wells to flow by having the gas turned into the petroleum wells. The gas under pressure spread itself over the surface of the petroleum in the porous limestone and thereby started the wells to flow.

Toward the close of the year there was a company organized to supply Beaumont, but the declining pressure in the field caused the undertaking to be abandoned.

All of the large producing wells when flowing gave out more or less natural gas, which is highly charged with sulphuretted hydrogen, and is very deadly in effect when taken into the lungs in large quantities.

During the year a very large gas well was developed on Bryans Mound, near the shore of the Gulf, and near the Brazos River, in Brazoria County, which gave a persistent supply of 2,000,000 to 3,000,000 cubic feet per day.

Numerous artesian wells along the Gulf coast give off considerable natural gas with the artesian water, whose flow is no doubt caused by the expansion of the gas rather than by a hydraulic head.

CANADA.

The Welland County field in Ontario, near Buffalo, continues to furnish gas to Buffalo, N. Y. The Essex County field formerly furnished a large amount of natural gas to Detroit, Mich. The drain on both of these fields has been felt, as there has been a very considerable reduction in the rock pressure. There is some natural gas found in the oil region between Petrolia and Sarnia, which is mostly used in gas engines that are pumping oil wells. The value of the production for 1901 shows a decrease of over $100,000, as compared with that of 1900 These figures are supplied by the Mineral Statistics and Mining Bureau, Ottawa, Canada.

The value of the natural gas produced in Canada from 1892 to 1901 is shown in the following table:

Value of natural gas produced in Canada from 1892 to 1901, inclusive.

Year.	Value.	Year.	Value.
1892	$150,000	1897	$325,873
1893	366,233	1898	364,699
1894	313,754	1899	387,271
1895	423,032	1900	417,094
1896	364,156	1901	312,359

The value of natural gas piped from Canada to the United States and consumed in the cities of Detroit and Buffalo during the year 1901 amounted to $361,719, as compared with $672,362 in the year 1900, a decrease of $310,643. The supply was shut off from Detroit, Mich., the latter part of August, 1901, by order of the Canadian Government, which accounts in part for the large falling off in the amount exported into the United States during 1901.

The following table, furnished by the Bureau of Mines, Toronto, shows the number of producing wells, miles of pipe, workmen employed, value of the gas product at the point of production, and the wages for labor. The values are generally placed at the points of consumption:

Statistics of natural-gas production in the Province of Ontario, Canada.

Year.	Producing wells.	Miles of gas pipe.	Workmen employed.	Value of gas product.	Wages for labor.
1893	107	117	59	$238,200	$24,592
1894	110	183½	99	204,179	53,130
1895	123	248	92	282,986	73,328
1896	141	287¼	87	276,710	47,527
1897	140	297	84	308,448	42,338
1898	142	315¼	85	301,599	31,457
1899	150	341½	95	440,904	40,149
1900	175	306	161	392,823	43,636
1901	158	368	129	342,183	59,140

ASPHALTUM AND BITUMINOUS ROCK.

By JOSEPH STRUTHERS.

INTRODUCTION.

The general term "asphaltum" may be applied to the numerous varieties of hydrocarbons of an asphaltic base which exist in all conditions from the liquid to the solid state. In this report, however, it is specifically used to include all the purer forms of hard and soft bitumen, i. e., elaterate, gilsonite, albertite, wurtzilite, uintaite, nigrite, brea, etc. The statistics of crude petroleum, which may also be included in the general term "asphaltum," are given in the chapter devoted to petroleum. A large quantity of asphaltic oil is produced in California, which is refined for illuminating and lubricating oils, and as there is no strict line of demarcation between oils which should be considered as petroleum and those which should be considered as asphaltum, the general rule has been observed to include under asphaltum only material used as such, for instance, the residuum from petroleum-refining processes which is sold and used as asphalt. A slight duplication may arise in a few instances from this arbitrary classification, but it is impracticable to separate the two products absolutely. The term "bituminous rock" includes sandstones and limestones impregnated with asphaltum or bitumen which are sold and shipped without previous refining. The rock is used principally for street pavement and is mixed with other ingredients at the place of use. An inconsiderable portion of bituminous rock is treated to obtain asphaltum or bitumen, the product being sold as refined or gum asphalt. The asphalt and bituminous rock deposits of the United States have been described in great detail by George H. Eldridge in the Twenty-second Annual Report of the United States Geological Survey (for 1900–1901), Part I, pages 219–252.

PRODUCTION.

The following table shows the annual production of asphaltum and bituminous rock in the United States from 1882 to 1901, inclusive:

Production of asphaltum and bituminous rock from 1882 to 1901, inclusive.

Year.	Quantity.	Value.	Year.	Quantity.	Value.
	Short tons.			*Short tons.*	
1882	3,000	$10,500	1892	87,680	$445,375
1883	3,000	10,500	1893	47,779	372,232
1884	3,000	10,500	1894	60,570	355,400
1885	3,000	10,500	1895	68,163	348,281
1886	3,500	14,000	1896	80,503	577,563
1887	4,000	16,000	1897	75,945	664,632
1888	50,450	187,500	1898	76,337	675,649
1889	51,735	171,537	1899	75,085	553,904
1890	40,841	190,416	1900	54,389	415,958
1891	45,054	242,264	1901	63,134	555,335

As will be seen from the above table, the production of asphaltum and bituminous rock in 1901 shows an increase from that of 1900 amounting in quantity to 8,745 tons, and in value to $139,377. The production in 1900 and 1901, both in quantity and in value, has been the smallest in the last seven years.

The production of bituminous sandstone decreased from 38,334 short tons, valued at $119,779, in 1900 to 34,248 short tons, valued at $138,601, in 1901. The production of bituminous limestone increased from 2,434 short tons, valued at $11,322, in 1900 to 6,970 short tons, valued at $33,375, in 1901.

The production of hard and refined asphaltum, which includes gilsonite and similar pure varieties, increased from 12,367 tons in 1900, valued at $256,793, to 19,316 short tons, valued at $333,509, in 1901. The production of liquid asphaltum or maltha, all of which was derived from California, increased from 1,254 short tons in 1900, valued at $28,064, to 2,600 short tons, valued at $49,850, in 1901. No sales of mastic were reported during 1899, 1900, or 1901, the crude material from which it was previously made being now included in the output of bituminous sandstone and bituminous limestone.

With regard to the valuation assigned to the various asphaltum products, it is impracticable, if not impossible, to give exact figures, as the value depends largely on local conditions of supply and demand. For the year 1901 the value given to each product has been derived from signed statements of producers, with such modifications as have been warranted by information obtained directly from other authentic sources.

The following table shows the production and value of the several kinds of asphaltum and asphaltum products in 1897, 1898, 1899, 1900, and 1901. Both quantity and value are for the product in the condition in which it was first sold.

Varieties of asphaltum, etc., produced in 1897, 1898, 1899, 1900, and 1901.

Variety.	1897.		1898.		1899.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Short tons.		*Short tons.*		*Short tons.*	
Bituminous sandstone	48,801	$158,914	43,624	$126,831	43,041	$121,023
Bituminous limestone [a]	2,100	10,600	5,502	26,412	15,650	79,500
Mastic	483	9,864	1,158	17,840	....	....
Hard and refined or gum [b]	9,911	173,904	13,178	233,566	15,694	343,730
Liquid or maltha	14,650	311,350	12,875	271,000	700	9,651
Total	75,945	664,632	76,337	675,649	75,085	553,904

Variety.	1900.		1901.	
	Quantity.	Value.	Quantity.	Value.
	Short tons.		*Short tons.*	
Bituminous sandstone	38,334	$119,779	34,248	$138,601
Bituminous limestone [a]	2,434	11,322	6,970	33,375
Mastic	....	....	....	....
Hard and refined or gum [b]	12,367	256,793	19,316	333,509
Liquid or maltha	1,254	28,064	2,600	49,850
Total	54,389	415,958	63,134	555,335

[a] Not including mastic or refined asphaltum made from bituminous limestone.

[b] Including gilsonite from Colorado and Utah, gum asphaltum from Texas, and "Ventura," hard asphaltum from California.

IMPORTS.

The importation of asphaltum into the United States is chiefly from the island of Trinidad, off the coast of Venezuela. In addition, imports of asphalt are made from Bermudez, Venezuela; bituminous limestones are imported from Neuchatel and Val de Travers, in Switzerland, from Seyssel in France, and, in small quantities, from Germany, Cuba, Mexico, and other countries. Comparing the table of imports with the table of domestic production, it is seen that the value of the domestic product in 1901 was about equal to that of the imported asphalt. In this connection, however, it should be stated that the value of the imported asphaltum is at the point of shipment, and does not include freight charges or import duties.

The following table shows the imports of crude asphaltum since 1867:

Crude asphaltum imported into the United States from 1867 to 1901, inclusive.

Year ending—	Quantity.	Value.	Year ending—	Quantity.	Value.
June 30—	*Long tons.*		June 30—	*Long tons.*	
1867	....	$6,268	1885	18,407	$88,087
1868	185	5,632	Dec. 31—		
1869	203	10,559	1886	32,565	108,528
1870	488	13,072	1887	30,808	95,735
1871	1,301	14,760	1888	36,494	84,045
1872	1,474	35,533	1889	61,952	138,163
1873	2,314	38,298	1890	73,861	223,368
1874	1,183	17,710	1891	102,433	299,350
1875	1,171	26,006	1892	120,255	336,868
1876	807	23,818	1893	74,774	196,314
1877	4,532	36,550	1894	102,505	313,680
1878	5,476	35,932	1895 [a]	79,557	210,556
1879	8,084	39,635	1896 [a]	96,192	304,596
1880	11,830	87,889	1897 [a]	115,528	392,770
1881	12,883	95,410	1898 [b]	69,857	203,385
1882	15,015	102,698	1899 [c]	106,474	425,263
1833	33,116	149,999	1900 [d]	118,771	454,732
1884	36,078	145,571	1901 [e]	138,833	553,473

[a] In addition to the crude asphaltum imported in 1895 there was some manufactured or refined gum asphaltum, valued at $36,664. In 1896 the value of the manufactured asphaltum imported was $77,449, and in 1897, $25,095. The quantity was not reported.

[b] Includes 3,069 long tons, "dried or advanced," valued at $17,005.

[c] Includes 4,264 long tons, "dried or advanced," valued at $35,395.

[d] Includes 5,141 long tons, "dried or advanced," valued at $49,242.

[e] Includes 6,754 tong tons, "dried or advanced," valued at $36,958.

The following statement shows the quantity and value of the asphaltum imported during the fiscal years ending June 30, 1898, 1899, 1900, and 1901, with the countries from which it was exported. The quantity credited to Italy in 1897 was probably wholly or in part from Switzerland, though shipped through some Italian seaport.

The most noticeable features about this table are the comparatively large imports from Italy, 12,941 long tons as against nothing in 1900, and the continued largely increased imports from Trinidad and Venezuela in 1901. The imports from Trinidad increased from 93,687 long tons in 1900 to 115,584 long tons in 1901, about 23 per cent, and the imports from Venezuela amounted to 18,605 long tons as against 11,579 tons in 1900, an increase of 7,026 tons, or 60 per cent. The total imports from Trinidad and Venezuela in 1901 amounted to 134,189 long tons as against 105,266 tons in 1900.

Imports of asphaltum during the fiscal years 1898, 1899, 1900, and 1901, with the countries from which exported.

Country.	1898.		1899.	
	Quantity.	Value.	Quantity.	Value.
West Indies:	*Long tons.*		*Long tons.*	
British (Trinidad)	71,992	$217,660	68,916	$199,108
Cuba	137	2,172	109	2,090
Switzerland	98	830	837	7,653
Italy	1,260	7,531	6,443	28,276
Venezuela (Bermudez)	2,000	10,006	3,609	18,112
Germany	2,302	9,066	1,482	7,815
France	779	3,377	649	2,616
Spain			700	7,000
Mexico	438	5,773	32	714
Turkey in Asia	41	3,744	84	8,770
Great Britain	13	597	23	997
United States of Colombia		9		
Canada			3	80
Netherlands			6	209
Total	79,060	260,765	82,893	283,440

Country.	1900.		1901.	
	Quantity.	Value.	Quantity.	Value.
West Indies:	*Long tons.*		*Long tons.*	
British (Trinidad)	93,687	$277,378	115,584	$408,575
Dutch	25	263		
Cuba	553	14,009	4,888	19,162
Switzerland			867	7,244
Italy			12,941	54,046
Venezuela (Bermudez)	11,579	58,298	18,605	93,025
Germany	50	185	1,259	8,247
France	105	2,202	424	2,433
Mexico	40	642	95	1,648
Turkey in Asia	108	9,548		
Great Britain			48	1,871
United States of Colombia	5	48		
Canada			5	99
Netherlands	10	718	13	497
Total	106,162	363,291	154,729	596,847

PRODUCTION IN OTHER COUNTRIES.

TRINIDAD.

The island of Trinidad, off the coast of Venezuela, South America, one of the British West Indian possessions, is, next to France, the largest producer of asphaltum in the world.[a] The deposits are operated by an American corporation under a concession from the British Government, and, also independently, from land not belonging to the Crown, which was acquired by purchase. The chief source of the supply is a lake of pitch filling the crater of an extinct volcano. This lake lies 138 feet above sea level and has an area of 114 acres. The supply is being partly renewed by a constant flow of soft pitch into the center of the lake from a subterranean source. The shipments of lake pitch for the last ten years have averaged over 80,000 tons per year. The flow into the lake is at the rate of about 20,000 tons per year, so that the renewal of supply is less than one-fourth the amount taken out. The depth of the lake, however, is about 135 feet at the center, and considering the extent of the deposit, there need be little apprehension of the early exhaustion of supply of Trinidad asphaltum. The material from this lake is known as "lake pitch." Distinct from this is what is known as "land pitch," the overflow in past times of pitch from the lake, and deposits of similar nature but of different origin. The overflow pitch mingled with the soil, and while it, with the other land deposits, forms another source of supply, the quantity of mineral matter it contains is greater than the lake pitch, and the latter is in consequence preferred.

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[a] The French asphaltum is in reality a bituminous limestone of which the bitumen contents average only about 14 per cent. Trinidad Lake asphaltum, on the other hand, averages approximately 55 per cent bitumen. The product of France in 1898 was 252,358 short tons, of which the bitumen content was about 35,300 short tons. The shipments of lake asphaltum in crude and crude equivalent from Trinidad in the same year amounted to 86,959 long tons, or 97,394 short tons, of which the bitumen content, reckoned at 55 per cent, would be about 53,500 short tons. It will be seen from this that while France produced the largest amount in crude, Trinidad is the leader of the world in the bitumen content of its product. Land asphaltum, of which Trinidad produces over 20,000 tons annually has not been included in this comparison.

The exports of Pitch Lake asphaltum and land asphaltum, together with the total for both products, from Trinidad, 1886 to 1901, inclusive, are given in the following tables:

Exports of Pitch Lake asphaltum from Trinidad, 1881 to 1901, inclusive.

[In tons of 2,240 pounds.]

Year.	To United States.			To Europe.			To other countries.			Grand total of exports in crude equivalent.
	Crude.	Dried.	Total equivalent in crude.	Crude.	Épuré and dried.	Total equivalent in crude.	Crude.	Épuré and dried.	Total equivalent in crude.	
	Tons.	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*
1881	5,600	....	5,600	10,656	6,174	19,917	....	....	....	25,517
1882	12,710	....	12,710	24,712	12,007	42,722	....	....	....	55,432
1883	22,885	....	22,885	11,744	4,668	18,746	....	....	....	41,631
1884	17,885	....	17,885	15,910	6,561	25,751	....	....	....	43,636
1885	15,505	....	15,505	12,135	7,636	23,589	....	....	....	39,094
1886	22,225	....	22,225	5,130	5,394	13,221	....	....	....	35,446
1887	21,915	....	21,915	10,205	5,771	18,861	....	....	....	40,776
1888	24,321	....	24,321	8,445	8,248	20,817	....	....	....	45,138
1889	45,410	....	45,410	9,378	9,581	23,750	....	....	....	69,160
1890	39,907	....	39,907	11,755	9,951	26,681	668	....	[a] 668	67,256
1891	52,510	....	52,510	9,984	9,969	24,937	901	....	[a] 901	78,348
1892	70,806	....	70,806	11,596	9,458	25,783	1,076	....	[a] 1,076	97,665
1893	65,436	....	65,436	10,640	6,650	20,615	....	....	....	86,051
1894	71,860	....	71,860	8,967	9,413	23,086	....	....	....	94,946
1895	61,702	2,256	64,976	5,058	7,365	16,104	....	....	....	81,080
1896	60,637	....	60,637	8,320	8,052	20,391	....	1,300	[b] 1,918	82,946
1897	71,969	1,769	74,407	14,629	13,510	34,856	....	500	680	109,243
1898	46,089	1,692	48,423	15,703	13,228	35,537	[a] 693	[b] 1,646	2,999	86,959
1899 [c]	70,111	666	70,777	21,337	20,618	41,955	....	2,359	2,359	115,091
1900 [c]	67,758	3,180	70,938	23,386	23,966	47,352	1,422	3,031	4,453	122,743
1901	80,449	....	80,449	31,213	15,815	54,761	....	586	844	136,054

[a] Australia.

[b] Argentina and Mexico.

[c] The dried and "épuré" in 1899 and 1900 are not reduced to crude equivalents.

Exports of land asphaltum from Trinidad, 1886 to 1901, inclusive.

[In tons of 2,240 pounds.]

Year.	To United States.			To Europe.			To other countries.			Grand total of exports in crude equivalent.
	Crude.	Épuré.	Total equivalent in crude.	Crude.	Épuré.	Total equivalent in crude.	Crude.	Épuré.	Total equivalent in crude.	
	Tons.	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*
1886	2,297	....	2,297	....	....	....	....	....	....	2,297
1887	1,195	2,100	4,345	220	....	220	....	....	....	4,565
1888	5,316	1,536	7,620	619	....	619	....	....	....	8,239
1889	10,490	2,052	13,568	....	....	....	833	....	[a] 833	14,401
1890	15,406	1,341	17,417	....	....	....	....	....	....	17,417
1891	20,507	7	20,517	139	....	139	40	....	[b] 40	20,696
1892	17,406	....	17,406	699	....	699	....	....	....	18,105
1893	3,450	....	3,450	2,432	1,862	5,225	110	178	[b] 377	9,052
1894	3,365	325	3,853	2,200	4,699	9,249	13	94	[b] 154	13,256
1895	4,445	199	4,744	1,770	2,368	5,322	....	169	[b] 254	10,320
1896	11,943	71	12,049	842	1,988	3,824	....	....	....	15,873
1897	19,243	....	19,243	293	700	1,343	415	178	682	21,268
1898	15,160	....	18,160	700	258	1,087	404	312	872	20,119
1899 [c]	24,622	542	25,164	275	250	525	80	298	378	26,067
1900 [c]	33,936	860	34,796	251	....	251	127	70	197	35,244
1901	31,767	(d)	31,767	1,704	(d)	1,704	1,446	....	1,446	34,917

[a] Australia.

[b] Canada, Venezuela, and West Indies.

[c] The dried and "épuré" in 1899 and 1900 are not reduced to crude equivalents.

[d] Included in shipments of crude.

Total exports of all asphaltum from Trinidad, 1886 to 1901, inclusive.

[In tons of 2,240 pounds.]

Year.	To United States.			To Europe.			To other countries.			Grand total.
	Lake.	Land.	Total.	Lake.	Land.	Total.	Lake.	Land.	Total.	
	Tons.	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*
1886	22,225	2,297	24,522	13,221	....	13,221	....	....	....	37,743
1887	21,915	4,345	26,260	18,861	220	19,081	....	....	....	45,341
1888	24,321	7,620	31,941	20,817	619	21,436	....	....	....	53,377
1889	45,410	13,568	58,978	23,750	....	23,750	....	833	833	83,561
1890	39,907	17,417	57,324	26,681	....	26,681	668	....	668	84,673
1891	52,510	20,517	73,027	24,937	139	25,076	901	40	941	99,044
1892	70,806	17,406	88,212	25,783	699	26,482	1,076	....	1,076	115,770
1893	65,436	3,450	68,886	20,615	5,225	25,840	....	377	377	95,103
1894	71,860	3,853	75,713	23,086	9,249	32,335	....	154	154	108,202
1895	64,976	4,744	69,720	16,104	5,322	21,426	....	254	254	91,400
1896	60,637	12,049	72,686	20,391	3,824	24,215	1,918	....	1,918	98,819
1897	74,407	19,243	93,650	34,856	1,343	36,199	680	682	1,362	130,511
1898	48,423	18,160	66,583	35,537	1,087	36,624	2,999	872	3,871	107,078
1899 [a]	70,777	25,164	95,941	41,955	525	42,480	2,359	378	2,737	141,158
1900 [a]	70,938	34,796	105,734	47,352	251	47,603	4,453	197	4,650	157,987
1901	80,449	31,767	112,216	54,761	1,704	56,465	844	1,446	2,290	170,971

[a] The dried and "épuré" in 1899 and 1900 are not reduced to crude equivalents.

OTHER COUNTRIES.

Outside of Trinidad and France the more important asphaltum-producing countries are Germany, Italy, Switzerland, Venezuela, Russia, Austria-Hungary, and Spain. No statistics are available regarding the production of Switzerland. Small quantities of asphaltum are also produced in Mexico, Turkey in Asia, Great Britain, the United States of Colombia, Canada, and the Netherlands.

PRODUCTION IN PRINCIPAL PRODUCING COUNTRIES.

In the following table is given a statement of the production of asphaltum in the principal producing countries since 1890:

Production of asphaltum in principal producing countries since 1890.

Year.	United States.		Trinidad.		Germany.	
	Product.	Value.	Product.	Value.	Product.	Value.
	Short tons.		*Short tons.*		*Short tons.*	
1890	40,841	$190,416	94,834	$254,019	59,361	$89,961
1891	45,054	242,264	110,929	297,132	54,163	89,419
1892	87,680	445,375	129,438	347,310	58,713	99,686
1893	47,779	372,232	106,515	285,309	52,056	84,962
1894	60,570	353,400	121,186	324,606	61,691	107,350
1895	68,163	348,281	102,368	274,200	65,638	108,153
1896	80,503	577,563	110,667	296,457	67,830	107,908
1897	75,945	664,632	146,172	292,344	67,933	91,984
1898	76,337	675,649	112,220	553,890	75,550	99,088
1899	75,085	553,904	153,870	745,242	82,397	123,984
1900	54,389	415,958	177,751	855,744	98,833	160,000

Year.	France.		Italy.		Spain.	
	Product.	Value.	Product.	Value.	Product.	Value.
	Short tons.		*Short tons.*		*Short tons.*	
1890	198,934	$335,092	49,728	$232,351	47	$94
1891	278,316	402,631	31,054	131,028	274	505
1892	246,848	323,854	38,107	162,308	554	1,014
1893	244,644	311,116	28,630	109,200	904	1,235
1894	254,562	339,294	66,663	270,854	1,085	1,939
1895	294,234	355,700	51,478	197,584	870	1,525
1896	249,052	336,013	50,092	171,507	1,231	2,156
1897	257,127	328,002	60,984	183,017	1,825	3,196
1898	252,358	322,117	103,312	256,347	2,604	4,605
1899	285,208	356,719	90,350	222,519	2,801	4,964
1900	293,654	383,429	112,115	292,287	4,621	8,632

STONE.[a]

INTRODUCTION.

In this report stone is classified, as usual in the trade, under the general headings of granite, sandstone, limestone, slate, and marble.

Under the head of granite are included granites and gneisses, which are used for all purposes for which granite is used, such as building stone, foundation work, monumental stone, paving blocks, curbstone and flagstone, rubble, crushed stone for riprap, macadam roads, concrete, and railroad ballast. Besides these the following are also included: The diabase or trap rocks and the basalts, quarried extensively in the New England and Eastern States and in California, and used almost entirely for paving, or crushed for road metal; the lava stone or tuffs of Colorado and other Western States; many quartzites, some of which are used as refractory material in furnaces and are called ganister; and the jasper stone of Minnesota.

Under sandstone are included all consolidated sands. The value of the stone depends upon the cementing material, quartz grains cemented by silica forming the hardest and most durable stone. The varieties of sandstone are often called by the quarrymen bluestone, freestone, and (when the grains composing the stone are of considerable size) conglomerates. As such they are classed as sandstone in this report. Some bituminous sandstone is included also.

Limestone, when in its pure state, consists essentially of amorphous calcium carbonate, often cemented together by crystalline material and containing many impurities. In this report there is included with true limestone not only the calcium carbonate with the usual small amounts of impurities, such as the oxides of iron, aluminum, silica, etc., but stone containing calcium carbonate and magnesium carbonate in varying proportions. When the stone contains a considerable amount of magnesium carbonate it is called magnesium limestone, and when the stone is about equally composed of the carbonate of lime and of magnesia it is called dolomite. The limestones also include travertine, or the limestone deposited by running streams and springs in large compact masses, and fossiliferous, shell, and coral limestones. In composition there is no essential difference between limestone and what is generally known as marble. Marble is, however, limestone that by action of heat has been transformed into a crystalline form. There is also included with the marble some onyx marble, which in composition is the same as marble, but which is deposited from solution in crystalline form at different intervals, thus giving it a banded appearance and variegated colors. There is also included a small amount of serpentine.

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[a] The severe illness of Dr. William C. Day, referred to in the previous volume, has continued, and this report has been prepared by Miss Altha T. Coons, statistical expert.—Ed.

VALUE OF STONE PRODUCED IN 1900 AND 1901.

The value of the entire production of stone in the United States in 1901 was $60,982,060. In 1900 the value was $48,686,655, a gain of $12,295,405 in 1901 over the value of the product in 1900. This enormous increase in value was shared in by all kinds of stone. The total value as given above includes values for grindstones, whetstones, and for limestone for blast-furnace flux which are not included in 1900 and 1901 in the table showing the total value of the various kinds of stone for the last eleven years.

Limestone, including blast-furnace flux, showed the greatest increase—from $20,354,019 in 1900 to $26,406,897 in 1901, or $6,052,878, or 30 per cent.

Granite showed the next greatest increase—from $12,675,617 in 1900 to $15,976,961 in 1901, or $3,301,344, or over 26 per cent. This includes the value of trap rock, which increased slightly—from $1,706,200 in 1900 to $1,710,857 in 1901, or $4,657.

Sandstone increased from $7,149,300 in 1900 to $8,844,978 in 1901, an increase of $1,695,678, or 24 per cent. This includes the value of grindstones, whetstones, and bluestone. The production of bluestone decreased from a value of $1,198,519 in 1900 to $1,164,481 in 1901, a decrease of $34,038.

The marble production increased in value from $4,267,253 in 1900 to $4,965,699 in 1901, or $698,446, or 16 per cent.

The slate production in 1901 increased in value from $4,240,466 in 1900 to $4,787,525 in 1901, or $547,059, or about 13 per cent.

One of the chief features of the industry in 1901 was the increase in the value of crushed stone, including the stone crushed for roads, or macadam, the stone crushed for concrete, and the stone used for railroad ballast. The amount of stone crushed for road work has been increasing steadily in the last few years, owing to the demand for good roads. Gravel roads, however, have somewhat taken the place of crushed stone roads, as being cheaper both to construct and to repair. On islands in the Mississippi River dredging has been carried on for gravel for use in concreting in place of the broken stone and shells formerly used. An increase is caused in the limestone production by the inclusion of a considerable quantity of limestone used in Portland cement manufacture. The increase in the building activity of the country is shown in the increase of the value of stone sold for building purposes, which showed a greater total increase than any other stone product, being followed in order by crushed stone, and stone used for riprap.

In the following table, which shows the value of the different kinds of stone produced in the United States in the last eleven years, the value of grindstones, whetstones, and blast-furnace flux is not included in 1900 and 1901, as these values are included, respectively, in the reports on abrasive materials and iron ore as published by this office.

Value of the different kinds of stone produced in the United States from 1891 to 1901, inclusive.

Year.	Granite.	Trap rock.	Marble.	Slate.	Sandstone.	Bluestone.	Limestone.	Total.
1891....	$13,867,000	....	$3,610,000	$3,825,746	$8,700,000	[a]$1,500,000	$15,792,000	$47,294,746
1892....	12,642,000	....	3,705,000	4,117,125	8,315,500	[a] 1,600,000	18,342,000	48,721,625
1893....	8,808,934	....	2,411,092	2,523,173	5,295,151	[a] 1,000,000	13,947,223	33,985,573
1894....	10,029,156	....	3,199,585	2,790,324	3,955,847	[a] 900,000	16,190,118	37,065,030
1895....	8,894,328	....	2,825,719	2,698,700	4,211,314	[a] 750,000	15,308,755	34,688,816
1896....	7,944,994	....	2,859,136	2,746,205	4,023,199	[a] 750,000	13,022,637	31,346,171
1897....	8,905,075	....	3,870,584	3,524,614	4,065,445	[a] 900,000	14,804,933	36,070,651
1898....	9,324,406	....	3,629,940	3,723,540	4,724,412	[a] 1,000,000	16,039,056	38,441,354
1899....	10,343,298	$1,275,041	4,011,681	3,962,733	[b] 4,924,670	815,284	18,757,963	44,090,670
1900....	10,969,417	1,706,200	4,267,253	4,240,466	[b] 5,272,865	1,198,519	[c] 16,666,625	44,321,345
1901....	14,266,104	1,710,857	4,965,699	4,787,525	[b] 6,974,199	1,164,481	[c] 21,747,061	55,615,926

[a] Estimated.

[b] Does not include grindstones and whetstones.

[c] Does not include value of limestone for flux.

The following tables show the value of stone produced in 1900 and 1901, by States:

Value of various kinds of stone produced in 1900, by States.

State.	Granite.	Sandstone.	Slate.	Marble.	Limestone.	Total.
Alabama	....	$7,132	....	$500	$533,608	$541,240
Arizona	....	64,000	....	5,000	165	69,165
Arkansas	$62,500	104,923	....	....	71,407	238,830
California	[a] 738,993	200,090	$26,500	17,500	407,489	1,390,572
Colorado	143,054	119,658	....	....	160,587	423,299
Connecticut	[a] 507,754	192,593	....	....	148,060	848,407
Delaware	608,028	....	....	....	....	608,028
Florida	....	....	....	....	128,381	128,381
Georgia	380,434	600	9,375	631,241	54,451	1,076,101
Idaho	2,450	438	....	1,250	34,587	38,725
Illinois	....	19,141	....	....	1,881,151	1,900,292
Indiana	....	45,063	....	....	2,344,818	2,389,881
Iowa	....	19,063	....	....	586,410	605,473
Kansas	30,000	55,173	....	....	339,466	424,639
Kentucky	....	56,178	....	....	178,252	234,430
Louisiana	....	[b] 118,192	....	....	....	118,192
Maine	1,568,573	....	177,342	....	691,312	2,437,227
Maryland	486,822	6,655	128,673	70,000	317,207	1,009,357

[a] Includes trap rock.

[b] Includes small amount for Mississippi.

Value of various kinds of stone produced in 1900, by States—Continued.

State.	Granite.	Sandstone.	Slate.	Marble.	Limestone.	Total.
Massachusetts	[a] $1,698,605	$153,427	......	$130,735	$209,359	$2,192,126
Michigan	3,957	238,650	......	......	425,636	668,243
Minnesota	221,684	267,000	$700	......	441,554	930,938
Missouri	139,103	53,401	......	900	1,079,343	1,272,747
Montana	[b] 9,091	59,630	......	1,200	141,093	211,014
Nebraska	......	......	......	......	[b] 107,305	107,305
New Hampshire	870,646	......	......	......	......	870,646
New Jersey	[a] 1,170,555	198,234	13,600	......	170,006	1,552,395
New Mexico	......	2,500	......	4,500	......	7,000
New York	[a] 446,171	[c] 1,467,496	62,755	332,518	1,730,162	4,039,102
North Carolina	257,962	27,210	......	......	([d])	285,172
Ohio	......	2,233,596	......	......	1,969,387	4,202,983
Oklahoma	......	......	......	......	25,586	25,586
Oregon	5,313	5,450	......	......	10,900	21,663
Pennsylvania	[a] 396,271	[c] 1,050,248	2,713,598	151,167	3,800,318	8,111,602
Rhode Island	444,316	......	......	......	16,828	461,144
South Carolina	500,802	......	......	......	[e] 38,415	539,217
South Dakota	114,115	12,675	......	......	47,762	174,552
Tennessee	......	11,300	250	424,054	238,505	674,109
Texas	76,069	37,038	......	......	124,728	237,835
Utah	2,170	66,733	......	......	12,749	81,652
Vermont	1,113,788	......	917,462	2,484,852	188,100	4,704,202
Virginia	211,080	6,000	190,211	......	403,318	810,609
Washington	48,900	68,133	......	11,836	249,163	378,032
West Virginia	......	72,438	......	......	53,701	126,139
Wisconsin	407,711	81,571	......	......	989,685	1,478,967
Wyoming	8,700	27,671	......	......	3,065	39,436
Total	[a] 12,675,617	[c] 7,149,300	4,240,466	4,267,253	20,354,019	48,686,655

Value of various kinds of stone produced in 1901, by States.

State.	Granite.	Sandstone.	Slate.	Marble.	Limestone.	Total value.
Alabama	......	$8,680	......	......	$619,423	$628,103
Alaska	......	......	......	$4,500	......	4,500
Arizona	......	202,500	......	300	300	203,100
Arkansas	$23,554	62,825	......	300	68,319	154,998
California	[a] 1,134,675	301,028	$18,608	6,642	645,455	2,106,408
Colorado	138,996	237,331	......	......	245,799	622,126
Connecticut	[a] 616,654	146,814	......	......	140,424	903,892
Delaware	671,204	......	......	......	......	671,204
Florida	......	......	......	......	51,870	51,870
Georgia	761,646	......	3,000	936,549	85,629	1,786,824
Idaho	5,100	20,843	......	......	21,251	47,194
Illinois	......	12,884	......	......	2,793,837	2,806,721
Indiana	......	34,959	......	......	2,993,186	3,028,145
Indian Territory	([f])	......	......	......	......	([f])
Iowa	......	14,341	......	......	777,484	791,825
Kansas	[g] 48,530	49,901	......	......	478,986	577,417
Kentucky	......	108,259	......	......	199,567	307,826
Maine	2,703,116	......	202,325	......	715,272	3,620,713

[a] Includes trap rock.

[b] Includes small amount for Nevada.

[c] Includes bluestone.

[d] Included with South Carolina.

[e] Includes small amount for North Carolina.

[f] Included with Kansas.

[g] Includes Indian Territory.

Value of various kinds of stone produced in 1901, by States—Continued.

State.	Granite.	Sandstone.	Slate.	Marble.	Limestone.	Total value.
Maryland	$613,356	$4,546	$105,798	$68,100	$382,381	$1,174,181
Massachusetts	[a] 2,216,258	247,310	....	126,546	244,039	2,834,153
Michigan	2,706	290,578	....	....	565,931	859,215
Minnesota	260,105	246,685	1,400	....	522,778	1,030,968
Missouri	95,806	42,170	....	2,100	1,362,272	1,502,348
Montana	15,200	60,719	....	1,500	143,866	221,285
Nebraska	....	515	....	....	154,717	155,232
Nevada	4,100	....	....	....	....	4,100
New Hampshire	935,494	....	....	....	....	935,494
New Jersey	[a] 894,167	244,512	30,000	....	309,738	1,478,417
New Mexico	....	....	....	10,600	....	10,600
New York	[a] 489,828	[b] 1,331,327	100,960	379,159	1,738,716	4,039,990
North Carolina	261,288	11,682	....	....	8,266	281,236
Ohio	....	2,576,723	....	....	2,606,502	5,183,225
Oklahoma Territory	....	....	....	....	32,497	32,497
Oregon	10,754	531	....	500	24,520	36,305
Pennsylvania	[a] 486,008	[b] 2,063,082	2,984,264	157,547	5,081,387	10,772,288
Rhode Island	501,698	....	....	....	38,030	539,728
South Carolina	996,084	....	....	....	28,500	1,024,584
South Dakota	99,941	17,647	....	....	53,780	171,368
Tennessee	....	10,342	....	494,637	330,927	835,906
Texas	27,005	111,568	....	....	209,658	348,231
Utah	5,588	38,919	....	320	78,900	123,727
Vermont	1,245,828	....	1,162,191	2,753,583	205,138	5,366,740
Virginia	275,701	5,303	178,979	....	[d] 986,177	1,416,160
Washington	43,808	89,174	....	22,816	234,587	390,385
West Virginia	....	106,710	....	....	([e])	106,710
Wisconsin	389,953	90,425	....	....	1,225,448	1,705,826
Wyoming	2,810	54,145	....	....	1,340	58,295
Total	[a] 15,976,961	[b] [c] 8,844,978	4,787,525	4,965,699	[f] 26,406,897	60,982,060

[a] Includes trap rock.

[b] Includes bluestone.

[c] Includes grindstones and whetstones.

[d] Includes West Virginia.

[e] Included with Virginia.

[f] Includes blast-furnace flux.

From the above tables it will be seen that Pennsylvania, producing every kind of stone, ranks first in the total valuation of the stone produced. Vermont is second in rank, and Ohio, which produces, however, only limestone and sandstone, third. New York is fourth, followed by Maine, Indiana, Massachusetts, and Illinois in the order named. Each of these States has a product of over $2,000,000. The drop from the value of the Pennsylvania product to the value of the Vermont product, the second State, is noticeable. Pennsylvania's entire stone product is valued at $10,772,288, and Vermont's product at $5,366,740.

In 1900 the rank of the States was the same.

The following table is given to show the total values of the stone used for various purposes in 1900 and 1901. Only those values are given which are for uses common to two or more varieties of stone, or where the values of the different varieties have been compiled in a similar manner.

Value of granite, limestone, sandstone, and marble used for various purposes in 1900 and 1901.

1900.

Kind.	Dressed for building purposes.	Dressed for monumental work.	Paving.	Curbstone and flagging.	Crushed for roads.	Riprap, rubble, etc.
Granite	$3,233,224	$1,598,842	$1,006,296	$593,209	$2,571,899	$1,216,871
Limestone	4,330,706			(a)	3,953,469	582,488
Marble	900,969	2,019,474				
Sandstone	2,207,699		(b)	2,071,887	(c)	(c)
Total	10,672,598	3,618,316	1,006,296	2,665,096	6,525,368	1,799,359

1901.

Kind.	Dressed for building purposes.	Dressed for monumental work.	Paving.	Curbstone and flagging.	Crushed for roads.	Riprap, rubble, etc.
Granite	$3,781,294	$1,457,557	$1,821,431	$670,703	$3,003,443	$1,755,959
Limestone	5,219,310			463,925	5,271,642	1,024,109
Marble	1,236,023	1,948,892				
Sandstone	4,875,973		358,910	1,663,221	285,347	447,520
Total	15,112,600	3,406,449	2,180,341	2,797,849	8,560,432	3,227,588

[a] Not collected as such in 1900.

[b] Included in the value of curbstone and flagstone.

[c] Included in a value of $1,778,322 which was tabulated as "sold in rough" in 1900. (See page 31.)

The above table shows the great increase in the building stone produced in 1901, as compared with 1900. In 1900 it was valued at $10,672,598; in 1901 at $15,112,600, showing a gain of $4,440,002. The value of monumental and cemetery work decreased slightly, from $3,618,316 in 1900 to $3,406,449 in 1901.

Crushed stone increased in value from $6,525,368 in 1900 to $8,560,432 in 1901, a gain of $2,035,064. The figures for crushed sandstone are, however, not included in the total for 1900. The value of riprap, rubble, etc., increased also, although it is not possible to give the exact figures, as in 1900 the figures given mean riprap only, the rubble, both in granite and sandstone, being otherwise classified.

As the crushed-stone industry has become such a decided factor in the quarry trade, the following table is given, showing the production of crushed stone in 1901 according to the variety of stone, and showing also the purpose for which this stone was used.

Value of crushed stone in the United States in 1901.

Kind.	Railroad ballast.	Road making.	Concrete.	Total value.
Limestone	$1,758,541	$2,298,286	$1,214,815	$5,271,642
Sandstone	30,887	130,503	123,957	285,347
Granite	516,768	2,008,966	477,709	3,003,443
Total	2,306,196	4,437,755	1,816,481	8,560,432

In 1900 no separation was made of the values of road material, railroad ballast, and concrete.

In the following table is shown, by States, the total value of the crushed stone produced in the United States in 1901.

Value of crushed stone produced in the United States in 1901, by States and Territories.

State or Territory.	Granite.	Limestone.	Sandstone.	Total value
Alabama		$2,500		$2,500
Arkansas	$5,877	1,000	$36,204	43,081
California	375,941	211,148	24,000	611,089
Colorado	2,190	100	15,500	17,790
Connecticut	216,306			216,306
Delaware	87,263			87,263
Florida		6,420		6,420
Georgia	98,170	13,581		111,751
Idaho		25		25
Illinois		1,155,746	20	1,155,766
Indiana		225,740		225,740
Indian Territory	450			450
Iowa		183,902	275	184,177
Kansas	37,333	137,283	450	175,066
Kentucky		99,415		99,415
Maine	90,499			90,499
Maryland	101,458	53,663		155,121
Massachusetts	191,823	150	65,400	257,373
Michigan	2,706	125,448		128,154
Minnesota	2,085	20,268	9,515	31,868
Missouri	27,862	295,470	2,896	326,228
Montana			2,300	2,300
Nebraska		67,309		67,309
New Hampshire	25,223			25,223
New Jersey	721,126	1,925	831	723,882
New York	320,610	627,884	18,715	967,209
North Carolina	85,083	4,668		89,751
Ohio		853,886	15,005	868,891
Oklahoma Territory		24,534		24,534
Oregon		12,100	49	12,149
Pennsylvania	369,078	746,895	56,942	1,172,915
Rhode Island	6,676			6,676
South Carolina	79,091	1,000		80,091
South Dakota	3,000			3,000
Tennessee		42,120	50	42,170
Texas		9,250	10,000	19,250
Utah		23		23
Vermont	2,107	610		2,717
Virginia	60,008	77,985		137,993
Washington	9,868	840	240	10,948
West Virginia			1,730	1,730
Wisconsin	81,610	268,729	1,519	351,858
Wyoming		25	23,706	23,731
Total	3,003,443	5,271,642	285,347	8,560,432

The division of this product, according to the uses to which the stone was put, is shown already in the table giving the values of the different varieties of stone by States and uses.

As the value of stone specified as used for railroad bridges, included in the tables with building stone, is considerable, the following table is given showing by States and variety of stone the value of the bridge stone used in the United States in 1901:

Value of stone used for bridge building in the United States in 1901.

State.	Sandstone.	Granite.	Limestone.	Total value.
Arizona	$180,000			$180,000
Illinois			$50,855	50,855
Indiana	15,720		6,474	22,194
Iowa	240		2,309	2,549
Kansas			118,848	118,848
Maine		$96,175		96,175
Maryland		34,160		34,160
Massachusetts		58,553		58,553
Minnesota			156,272	156,272
Missouri	3,750		43,000	46,750
New York	8,642		19,000	27,642
Ohio	108,084		533	108,617
Pennsylvania	726,897	8,500	1,702	737,099
Texas			1,800	1,800
West Virginia	67,000			67,000
Wisconsin			3,370	3,370
Total	1,110,333	197,388	404,163	1,711,884

IMPORTS AND EXPORTS.

The figures following, giving statistics of the imports and exports of stone for the United States, are taken from the data collected by the Bureau of Statistics of the Treasury Department. These statistics are collected by fiscal years, and when the figures for a special year are given the year ending June 30 of the year mentioned is meant.

The value of the stone imported into this country for the fiscal year ending June 30, 1901, was $1,276,602. This, when compared with a value of $1,028,550 for 1900 and of $883,852 for 1899, shows an increase of considerable magnitude, according well with the increase in the production of stone in the United States. The above values include marble and manufactured marble to the value of $680,533 in 1899, $812,606 in 1900, and $1,024,687 in 1901, and stone, including slate, both rough and manufactured, to the value of $203,319 in 1899, $215,944 in 1900, and $251,915 in 1901. The marble, including onyx, imported in blocks, rough or squared, was valued at $519,117 in 1900 and at $617,945 in 1901. The largest feature of the marble importation was the marble rough and manufactured from Italy, which amounted to $823,488 in 1901 and to $665,221 in 1900.

Besides the above there was imported into the United States lime valued at $58,066 in 1899, $63,900 in 1900, and $65,399 in 1901. Almost all of this lime was imported from Canada.

The total value of the stone exported from the United States in 1901 was $1,672,876 and in 1900, $1,762,023, showing a decrease of $89,147.

The chief value was for roofing slate, which was valued at $950,543 in 1900 and $898.262 in 1901. A table showing this production is given on page 42 of this report.

The value of unmanufactured stone exported was $93,720 in 1901 and $120,397 in 1900. Lime was exported in 1901 valued at $34,592, and in 1900 at $84,854.

The value for all other stone exported in 1901 was $606,229 and in 1900 $740,022.

GRANITE.

An increase in the value of the granite production in the United States from $12,675,617 in 1900 to $15,976,961 in 1901, or $3,301,344, shows that, as with the other varieties of stone, granite has made a marked increase in value of production. The increase in 1901 was more than in 1900 by $2,244,066, being $3,301,344 in 1901 and $1,057,278 in 1900.

This increase was greatest in the value of the stone sold in the rough, which increased from $2,455,276 in 1900 to $3,486,574 in 1901, a gain of $1,031,298. For the first time an effort has been made to classify the value of rough stock sold according to the uses for which it was sold. The building and monumental were the most prominent uses, $1,878,835 being the value of rough building stock, $1.257,668 being the value of rough monumental stock, $350,071 being devoted to other purposes, including some ganister and other uses to which no stated name was given on the schedule cards. In the valuation by States the State showing the greatest production of rough building stone was Maine, followed by Massachusetts, with Vermont in third place. In the value of rough monumental stock sold, Vermont held first rank, with Massachusetts second and, at a long interval, Rhode Island third.

The second increase of importance was in the value of the paving blocks made, which increased from $1,006,296 in 1900 to $1,821,431 in 1901, a gain of $815,135. Maine, Massachusetts, and Georgia were the States having the largest production. These figures show a decided improvement in the paving-block industry, which, for the last six years, has been influenced by the use of asphalt and brick. In 1901 paving blocks were used to some extent under asphaltum in the paving of streets. In 1894, the first year in which the production of paving blocks was noted as a separate item, the value was $2,254,587, and, for the succeeding years, the value decreased, until in 1898 the value was $854,151. In 1899 the value increased to $969,499; in 1900 to $1,006,296, and in 1901 to $1,821,431. In 1894, the year of the greatest productive value, Maine, Massachusetts, and Pennsylvania were the leading States in production, followed by Georgia. In 1900 Pennsylvania dropped very nearly to the end of the rank of the paving-block production, and Wisconsin, which showed a very small production in 1894, claimed third place. In 1901 Maine, Massachusetts, and Georgia, in the order named, were the States giving the greatest production, showing the change in the distribution of the demand.

The curbstone and flag produced increased from a value of $593,209 in 1900 to $670,703 in 1901, an increase of $77,494.

The value of dressed building stone sold by the producers was $3,781,294 in 1901 and $3,233,224 in 1900, an increase of $548,070. The greatest value of State production for this use was that of Maine, Massachusetts being second, New Hampshire third, and California in fourth place. In the dressed monumental work, the value decreased somewhat, being $1,598,842 in 1900 and $1,457,557 in 1901, a decrease of $141,285.

Owing to the increased demand for road metal—that is, railroad ballast, concrete, macadam, etc.—an effort has been made to collect the statistics of these separately. The total value of the crushed granite in 1901 was $3,003,443; in 1900, $2,571,899, a gain of $431,544. The value of railroad ballast, as shown by the table, was $516,768; of road metal (macadam, etc.), $2,008,966, and of concrete, $477,709. Delaware produced the greatest value for railroad ballast, California for concrete, and New Jersey for road-making material. North Carolina came second, California third, and Pennsylvania fourth in the value of railroad ballast; Pennsylvania second and New York third in value of road-making material; and Massachusetts second and Maryland third in the value of concrete. In this crushed material is included the trap rocks and basaltic rocks of New York, New Jersey, Pennsylvania, Delaware, California, Connecticut, and Massachusetts. A table is given, showing the value of trap rock in such States where the product of trap rock alone is large enough to have a decisive influence on the entire granite production, but not where the trap-rock production is represented by but one firm.

The total production given in the table shows that the value of trap rock in 1901 was $1,710,857, which was more than the value of 1900—$1,706,200—by $4,657. There was a decrease in the value of the output in New Jersey and California; on the other hand, Connecticut, Massachusetts, New York, and Pennsylvania gave an increased value.

The value of riprap, rubble, etc., increased from $1,216,871 in 1900 to $1,755,959 in 1901, or $539,088. South Carolina produced the greatest value of this product in 1901, and Delaware in 1900.

The following table shows the value of granite production in the United States from 1897 to 1901, inclusive:

Value of granite product from 1897 to 1901, inclusive.

State.	1897.	1898.	1899.	1900.	1901.
Arkansas	....	....	$39,470	$62,500	$23,554
California	$167,518	$247,429	471,665	738,993	1,134,675
Colorado	44,284	25,923	78,261	143,054	138,996
Connecticut	616,215	682,768	516,886	507,754	616,654
Delaware	272,469	677,754	1,039,349	608,028	671,204
Georgia	436,000	339,311	411,344	380,434	761,646
Idaho	....	....	....	2,450	5,100
Indian Territory	....	....	....	....	48,530
Kansas	....	....	....	30,000	
Maine	1,115,327	1,032,621	1,321,082	1,568,573	2,703,116
Maryland	247,948	317,258	423,823	486,822	613,356
Massachusetts	1,736,069	1,650,508	1,798,294	1,698,605	2,216,258
Michigan	....	....	....	3,957	2,706
Minnesota	92,412	79,309	159,459	221,684	260,105
Missouri	97,857	78,423	151,688	139,103	95,806
Montana	....	....	9,950	9,091	19,300
Nevada	3,050				
New Hampshire	641,691	683,595	802,636	870,646	935,494
New Jersey	561,782	753,513	779,822	1,170,555	894,167
New York	422,216	516,847	306,711	446,171	489,828
North Carolina	59,236	79,969	225,544	257,962	261,288
Oregon	1,125	....	3,012	5,313	10,754
Pennsylvania	349,947	237,780	385,101	396,271	486,008
Rhode Island	629,564	320,242	400,128	444,316	501,698
South Carolina	37,820	169,518	361,034	500,802	996,084
South Dakota	68,961	17,443	91,049	114,115	99,941
Texas	3,500	4,685	84,945	76,069	27,005
Utah	3,854	3,545	4,735	2,170	5,588
Vermont	1,074,300	1,084,218	1,212,967	1,113,788	1,245,828
Virginia	88,096	136,180	223,380	211,080	275,701
Washington	5,800	9,700	42,766	48,900	43,808
Wisconsin	126,134	175,867	270,538	407,711	389,953
Wyoming	....	....	2,700	8,700	2,810
Total	8,905,075	9,324,406	11,618,339	12,675,617	15,976,961

The following table shows the value of granite in the United States in 1900 and 1901, by States and uses:

Value of granite in the United States in 1900 and 1901, by States and uses.

1900.

State.	Sold in rough.	Dressed for building purposes.	Dressed for monumental work.	Made into paving blocks.	Curbing.	Crushed for roads.	Riprap.	Total.
Arkansas	$12,000			$4,000	$7,000	$28,500	$11,000	$62,500
California	47,539	$256,990	$34,159	33,006	17,116	238,991	111,192	738,993
Colorado	14,356	106,784	4,509	8,750	215	8,440		143,054
Connecticut	94,080	112,010	52,535	15,670	25,224	176,743	31,492	507,754
Delaware	7,912	5,348	1,000	28,191	3,459	36,558	525,560	608,028
Georgia	52,975	84,052	24,100	28,652	130,065	43,240	17,350	380,434
Idaho			2,450					2,450
Kansas						30,000		30,000
Maine	286,781	887,786	98,380	145,966	96,271	5,012	48,377	1,568,573
Maryland	127,608	164,181	13,400	71,855	24,520	84,151	1,107	486,822
Massachusetts	569,119	429,077	80,573	267,148	89,692	122,661	140,335	1,698,605
Michigan	3,957							3,957
Minnesota	19,598	104,955	72,934	3,896	11,199	5,450	3,652	221,684
Missouri	15,073	215	217	71,154	11,056	38,749	2,639	139,103
Montana Nevada	285	2,202	4,922		1,682			9,091
New Hampshire	193,471	299,418	242,026	58,512	37,427	15,126	24,666	870,646
New Jersey	100,130	176,608	800	51,697	337	838,621	2,362	1,170,555
New York	40,290	48,275	730	8,341	3,155	345,115	265	446,171
North Carolina	15,508	56,133	6,621	46,414	81,426	25,778	26,082	257,962
Oregon	993	1,500	2,500	320				5,313
Pennsylvania	71,454	14,761	507	13,189	10,664	285,296	400	396,271
Rhode Island	70,800	120,428	232,144	13,382	3,461	3,483	618	444,316
South Carolina	6,376	143,750	26,498	7,077	2,625	99,459	215,017	500,802
South Dakota	61,915	7,245	5,645	10,344	6,195	12,645	10,126	114,115
Texas	19,808	130	25,616		3,500	6,015	21,000	76,069
Utah	918	32	920				300	2,170
Vermont	526,370	49,763	527,053	225	2,735	1,472	6,170	1,113,788
Virginia	54,225	55,296	21,461	16,605	8,810	38,850	15,833	211,080
Washington	15,500	13,500	10,000		9,500		400	48,900
Wisconsin	19,335	90,985	107,142	101,902	5,875	81,544	928	407,711
Wyoming	6,900	1,800						8,700
Total	2,455,276	3,233,224	1,598,842	1,006,296	593,209	2,571,899	1,216,871	12,675,617

1901.

State.	Sold in the rough.			Dressed for building.	Dressed for monumental work.	Made into paving blocks.
	Building.	Monumental.	Other.			
Arkansas						$2,627
California	$24,057	$38,755	$6,815	$358,832	$72,257	46,300
Colorado	45,650	7,562		60,835	1,787	5,750
Connecticut	108,959	26,267	24,384	94,611	70,894	29,533
Delaware	9,069		2,678	1,750	400	32,191
Georgia	54,321	22,315	2,725	57,207	14,526	328,087
Idaho	100	5,000				

Value of granite in the United States in 1900 and 1901, by States and uses—Continued.

1901—Continued.

State.	Sold in the rough.			Dressed for building.	Dressed for monumental work.	Made into paving blocks.
	Building.	Monumental.	Other.			
Indian Territory	$2,340	...	...	$7,800	...	...
Kansas						
Maine	407,418	$24,475	$27,447	1,501,797	$76,276	$401,189
Maryland	181,608	20,180	1,500	188,568	7,800	51,637
Massachusetts	333,047	236,327	118,567	455,535	236,273	364,721
Michigan	...	...	...	...	...	...
Minnesota	13,215	42,197	1,550	55,017	96,902	20,002
Missouri	550	17,406	2,095	...	...	40,651
Montana	...	...	...	15,600	3,500	...
Nevada						
New Hampshire	156,832	52,231	9,797	363,957	171,239	112,581
New Jersey	60,905	2,515	...	19,888	...	87,933
New York	24,312	1,325	6,150	97,350	6,283	33,025
North Carolina	27,464	4,105	2,212	68,975	6,813	10,862
Oregon	3,748	250	1,590	3,900	1,116	...
Pennsylvania	63,568	1,050	4,538	18,916	227	15,712
Rhode Island	9,722	92,974	110	160,190	198,831	27,666
South Carolina	56,831	23,433	5,730	165,594	12,789	8,276
South Dakota	25,106	...	2,159	1,650	...	52,089
Texas	2,652	11,521	...	243	10,400	...
Utah	2,288	3,300	...	...	...	...
Vermont	208,825	534,755	101,779	16,343	354,563	16,304
Virginia	40,763	8,300	230	45,737	52,404	17,253
Washington	9,100	2,250	...	3,000	...	3,360
Wisconsin	3,575	79,175	28,015	17,999	62,277	113,682
Wyoming	2,810	...	...	...	...	...
Total	1,878,835	1,257,668	350,071	3,781,294	1,457,557	1,821,431

State.	Curbing and flagging.	Crushed stone.			Riprap, rubble, etc.	Total.
		Railroad ballast.	Road making.	Concrete.		
Arkansas	$12,496	...	$3,500	$2,377	$2,554	$23,554
California	22,200	$62,103	110,871	202,967	189,518	1,134,675
Colorado	397	...	750	1,440	14,825	138,996
Connecticut	14,358	...	213,672	2,634	31,342	616,654
Delaware	2,853	[a] 87,263	...	...	535,000	671,204
Georgia	155,920	25,700	35,545	36,925	28,375	761,646
Idaho	...	...	...	...	...	5,100
Indian Territory	62	37,333	...	450	545	48,530
Kansas						
Maine	124,535	25,325	59,714	5,460	49,480	2,703,116
Maryland	42,045	13,092	37,962	50,404	18,560	613,356
Massachusetts	146,325	5,455	135,775	50,593	133,640	2,216,258
Michigan	...	...	2,706	...	...	2,706
Minnesota	18,155	40	1,025	1,020	10,982	260,105
Missouri	3,142	...	27,862	...	4,100	95,806
Montana	200	...	...	...	...	19,300
Nevada						
New Hampshire	28,708	3,615	7,140	14,468	14,926	935,494
New Jersey	...	43,500	677,176	450	1,800	894,167

[a] Includes road making.

Value of granite in the United States in 1900 and 1901, by States and uses—Continued.

1901—Continued.

State.	Curbing and flagging.	Crushed stone.			Riprap, rubble, etc.	Total.
		Railroad ballast.	Road making.	Concrete.		
New York	$773	$40,000	$262,410	$18,200		$489,828
North Carolina	51,733	64,660	17,223	3,200	$4,041	261,288
Oregon	150					10,754
Pennsylvania	7,611	48,686	294,986	25,406	5,308	486,008
Rhode Island	2,456		5,676	1,000	3,073	501,698
South Carolina	2,723	46,835	21,806	10,450	641,617	996,084
South Dakota	795			3,000	15,142	99,941
Texas	2,189					27,005
Utah						5,588
Vermont	10,400	400	1,707		752	1,245,828
Virginia	7,977	7,841	9,850	42,317	43,029	275,701
Washington	9,000	4,920		4,948	7,230	43,808
Wisconsin	3,500		81,610		120	389,953
Wyoming						2,810
Total	670,703	516,768	2,008,966	477,709	1,755,959	15,976,961

The following tables show the value of the trap rock produced in the United States in 1900 and 1901, by States and uses:

Value of trap rock produced in the United States in 1900 and 1901, by States and uses.

1900.

State.	Sold in rough.	Made into paving blocks.	Crushed for roads or ballast.	Other purposes.	Total.
California	$750	$10,000	$117,062	$4,523	$132,335
Connecticut	3,701	767	144,293	1,427	150,188
Massachusetts	1,000		80,545		81,545
New Jersey	28,014	46,247	793,621	13,766	881,648
New York			171,773	12,627	184,400
Pennsylvania	5,573	21	270,444	46	276,084
Total	39,038	57,035	1,577,738	32,389	1,706,200

1901.

California		$1,250	$121,120	$4,627	$126,997
Connecticut		193	202,006	11,784	213,983
Massachusetts			128,079	2,469	130,548
New Jersey		83,922	633,129	44,286	761,337
New York		22,750	161,248	5,985	189,983
Pennsylvania		1,890	281,706	4,413	288,009
Total		110,005	1,527,288	73,564	1,710,857

The above tables show an increase of $4,657 in the total production. California and New Jersey show a loss in the value of the product, and the other States an increase.

SANDSTONE.

In collecting the sandstone figures in 1901 no effort was made to separate on the schedule cards the values of stones used for curbing and for flagstone. On many of the cards, however, the separation was made by the producers themselves, and as the value given for curbing reached a considerable amount, the figures are given as they were given by the quarrymen. The large table showing the value, by States and by uses, gives the value for grindstones and whetstones, and includes bluestone in New York and Pennsylvania; but in the table showing the value of the different kinds of stone, the value of the bluestone is shown separately from the sandstone and the value of grindstones and whetstones is not included in the sandstone total, as it is included in the report on abrasive materials as published by this office.

The value of the entire sandstone production in 1901 was $8,844,978, and in 1900 the value was reported as $7,149,300, showing an increase of $1,695,678. Ohio kept first rank in the production of sandstone, but Pennsylvania took second place, with New York third, while in 1900 New York was second and Pennsylvania third. The change of rank was due to a decrease in the New York production, owing to less activity in the quarries in and around Hulburton, Medina, and Holley; and a large increase in Pennsylvania, owing to a large amount of stone being used in the building of railroad bridges. These three are the only States whose production reached the million-dollar mark, Ohio having, in 1901, a production valued at $2,576,723; Pennsylvania, $2,063,082; and New York, $1,331,327. The highest production reached by any other State was $301,028, from the State of California.

The value of bluestone included in the total in 1901 was $1,164,481, as compared with $1,198,519 included in the figures for 1900, showing a decrease of $34,038 in the value of bluestone in 1901. The value of grindstones and whetstones included in the total in 1900 was $677,916; in 1901, $706,298. The value of the sandstone, exclusive of bluestone, was $7,680,497 in 1901 and $5,950,781 in 1900, showing a gain of $1,729,716 in 1901 as compared with 1900.

Pennsylvania showed the greatest production of building stone, with Ohio next. The inclusion of a large amount used for railroad bridges gave this increased product, as Ohio has always produced the most for this purpose. Pennsylvania also showed the greatest production of crushed rock for road material; New York and Minnesota, respectively, reported the greatest production for paving purposes; Ohio and Pennsylvania for riprap, rubble, etc.; New York and Ohio for curbing, and Ohio and New York for flagstones, and Ohio the greatest production of grindstones, followed by Michigan as second.

The following table shows the value of the sandstone production in the United States from 1897 to 1901, inclusive, by States:

Value of sandstone production in the United States from 1897 to 1901, inclusive, by States.

State.	1897.	1898.	1899.	1900.	1901.
Alabama	$3,000	$27,882	$71,675	$7,132	$8,680
Arizona	15,000	57,444	4,168	64,000	202,500
Arkansas	3,161	24,825	73,616	104,923	62,825
California	4,035	358,908	261,193	200,090	301,028
Colorado	60,847	89,637	129,815	119,658	237,331
Connecticut	364,604	215,733	271,623	192,593	146,814
Georgia	....	....	....	600	....
Idaho	....	....	....	438	20,843
Illinois	14,250	13,758	16,133	19,141	12.884
Indiana	35,561	45,342	35,636	45,063	34,959
Iowa	14,771	7,102	24,348	19,063	14,341
Kansas	20,953	19,528	49,629	55,173	49,901
Kentucky	40,000	72.525	119,982	56,178	108,259
Louisiana	8,000	200,500	[a] 226,503	[b] 118,192	....
Maryland	....	13,646	24,426	6.655	4,546
Massachusetts	194,684	91,287	131,877	153,427	247,310
Michigan	171,127	222,376	320,192	238,650	290,578
Minnesota	158,057	175,810	294,615	267.000	246,685
Missouri	57,583	48,795	57,662	53,401	42,170
Montana	25,644	3,682	26,160	59,630	60,719
Nebraska	....	....	....	....	515
New Jersey	190,976	257,217	147,768	198,234	244,512
New Mexico	....	3,500	1,829	2,500	....
New York	544,514	566,133	[c] 1,218,053	[c] 1,467,496	[c] 1,331,327
North Carolina	11,500	9,100	10,300	27,210	11,682
Ohio	1,600,058	1,494,746	1,775,642	2,233,593	2,576,723
Oregon	....	7,864	4,153	5,450	531
Pennsylvania	380,813	478,451	[c] 717,053	[c] 1.050,248	[c] 2,063,082
South Dakota	....	9,000	18,325	12,675	17,647
Tennessee	....	....	....	11,300	10,342
Texas	30,030	77,190	35,738	37,038	111,568
Utah	7,907	15,752	29,091	66,733	38,919
Virginia	....	....	8,000	6,000	5,303
Washington	16,187	15,575	58,395	68,133	89,174
West Virginia	47,288	14,381	33,860	72,438	106,710
Wisconsin	33,620	80,341	132,901	81,571	90,425
Wyoming	11,275	6,382	32,583	27,671	54,145
Total	4,065,445	4,724,412	6,362,944	7,149,300	8,844,978

[a] Includes small amounts for Idaho and Nevada.

[b] Includes Mississippi.

[c] Includes bluestone.

The following table shows the value of the standstone production in the United States in 1900 and 1901, by States and uses:

Value of sandstone produced in the United States in 1900 and 1901, by States and uses.

1900.

State.	Sold in rough.	Dressed for building purposes.	Sold for curbing and flagstones.	Sold for grindstones.	Sold for whetstones.	Other purposes.	Total.
Alabama	$3,745	$2,250	$1,137				$7,132
Arizona	14,000	50,000					64,000
Arkansas	58,538	8,055	31,010			$7,320	104,923
California	176,592	16,114	7,384				200,090
Colorado	59,387	31,478	22,793			6,000	119,658
Connecticut	52,646	127,540				12,407	192,593
Georgia		400	200				600
Idaho		438					438
Illinois	3,483	13,577	2,081				19,141
Indiana	23,096	6,394	320		$8,550	6,703	45,063
Iowa	3,058	15,052	771			182	19,063
Kansas	3,625	6,164	44,080			1,304	55,173
Kentucky	17,598	29,348	9,232				56,178
Louisiana[a]	118,192						118,192
Maryland	6,655						6,655
Massachusetts	47,283	78,644				27,500	153,427
Michigan	73,850	58,800		$102,000	4,000		238,650
Minnesota	74,318	84,895	107,787				267,000
Missouri	28,462	5,404	19,278			257	53,401
Montana	34,410	20,400	1,200			3,620	59,630
New Jersey	29,760	166,264	2,210				198,234
New Mexico		1,000	1,500				2,500
New York	59,405	301,109	[b]948,553			158,429	1,467,496
North Carolina	15,660	8,216	1,000			2,334	27,210
Ohio	501,071	530,005	612,968	542,721	6,915	39,936	2,233,596
Oregon	4,890	155	55			350	5,450
Pennsylvania	247,586	412,633	243,118	6,727	200	139,984	1,050,248
South Dakota	5,500	6,800	375				12,675
Tennessee		11,300					11,300
Texas	15,066	12,847	9,125				37,038
Utah	9,029	52,548	5,006			150	66,733
Virginia		6,000					6,000
Washington	38,211	29,172				750	68,133
West Virginia	6,615	58,700	300	6,823			72,438
Wisconsin	30,237	47,680	404			3,250	81,571
Wyoming	16,354	8,317				3,000	27,671
Total	1,778,322	2,207,699	2,071,887	658,271	19,645	413,476	7,149,300

[a] Includes Mississippi.

[b] Includes $225,592 used for paving purposes.

Value of sandstone produced in the United States in 1900 and 1901, etc.—Continued.

1901.

State.	Building purposes.	Crushed stone.			Paving.	Riprap, rubble, etc.
		Railroad ballast.	Road making.	Concrete.		
Alabama	$1,880					$2,000
Arizona	202,500					
Arkansas	10,805	$700	$15,136	$20,368	$2,000	3,278
California	230,521		23,000	1,000	29,594	16,633
Colorado	93,534		15,500			24,406
Connecticut	114,795					1,470
Idaho	20,843					
Illinois	8,720	20			523	355
Indiana	23,475				650	4,098
Iowa	13,491		275		251	178
Kansas	15,981	450			1,775	125
Kentucky	100,569				6,000	
Maryland	4,546					
Massachusetts	176,850		14,600	50,800		400
Michigan	128,909					26,519
Minnesota	85,800		3,015	6,500	82,500	52,870
Missouri	32,899		2,884	12	1,890	3,278
Montana	39,135			2,300		15,684
Nebraska	515					
New Jersey	211,318		756	75	64	18,705
New York	512,352	6,125	9,560	3,030	168,596	12,579
North Carolina	11,100					582
Ohio	936,650	2,000	5,230	7,775		95,536
Oregon	482		49			
Pennsylvania	1,544,621	20,157	28,919	7,866	65,067	78,243
South Dakota	13,325					4,272
Tennessee	10,180			50		
Texas	39,605		10,000			28,918
Utah	32,636					3,224
Virginia	4,703					600
Washington	67,480			240		20,050
West Virginia	95,406	1,435	60	235		5,660
Wisconsin	72,229		1,519			15,509
Wyoming	18,118			23,706		12,321
Total	4,875,973	30,887	130,503	123,957	358,910	447,520

Value of sandstone produced in the United States in 1900 and 1901, etc.—Continued.

1901—Continued.

State.	Curbing.	Flagstones.	Grindstones.	Whetstones.	Other purposes.	Total value.
Alabama					$4,800	$8,680
Arizona						202,500
Arkansas	$10,256	$232			50	62,825
California		280				301,028
Colorado		85,491			18,400	237,331
Connecticut					30,549	146,814
Idaho						20,843
Illinois		2,042			1,224	12,884
Indiana		111		$6,625		34,959
Iowa		71			75	14,341
Kansas		31,370			200	49,901
Kentucky		830			860	108,259
Maryland						4,546
Massachusetts					4,660	247,310
Michigan			$104,200	11,950	19,000	290,578
Minnesota					16,000	246,685
Missouri	146	464			597	42,170
Montana		200	2,280		1,120	60,719
Nebraska						515
New Jersey					13,594	244,512
New York	281,679	269,790			67,616	1,331,327
North Carolina						11,682
Ohio	233,965	510,568	548,844	28,699	207,429	2,576,723
Oregon						531
Pennsylvania	85,676	113,508			119,025	2,063,082
South Dakota					50	17,647
Tennessee					112	10,342
Texas	25,000	8,000			45	111,568
Utah		3,000			59	38,919
Virginia						5,303
Washington					1,404	89,174
West Virginia		214	3,700			106,710
Wisconsin		328			840	90,425
Wyoming						54,145
Total	636,722	1,026,499	659,024	47,274	507,709	8,844,978

The following table shows the value and uses of the bluestone produced in the United States in 1900 and 1901, by States:

Value and uses of bluestone produced in the United States in 1900 and 1901, by States.

1900.

State.	Flagging.	Curbing.	Gutters and crossings.	Coping, sills, lintels.	Other purposes.	Total value.
New York	$340,087	$169,332	$60,644	$181,773	$165,229	$917,065
Pennsylvania	90,609	46,227	7,031	12,179	125,408	281,454
Total	430,696	215,559	67,675	193,952	290,637	1,198,519

Value and uses of bluestone produced in the United States in 1900 and 1901, by States—Continued.

1901.

State.	Building purposes.	Flagging.	Curbing.	Gutter and crossings.	Coping, steps, sills, and lintels.	Other purposes.	Total value.
New York	$156,091	$230,453	$206,455	$32,466	$164,296	$48,363	$838,124
Pennsylvania	103,718	87,008	42,747	12,189	35,044	45,651	326,357
Total	259,809	317,461	249,202	44,655	199,340	94,014	1,164,481

SLATE.

The production of slate in 1901 showed an increase of $547,059 over that of 1900, the value advancing from $4,240,466 in 1900 to $4,787,525 in 1901. The increase was in the amount and value of the roofing slate, which increased from 1,194,048 squares, valued at $3,596,182, in 1900 to 1,304,379 squares in 1901, valued at $4,114,410, an increase of 110,331 squares, valued at $518,228. The average value per square advanced from $3.01 in 1900 to $3.15 in 1901, an increase of 14 cents. The value of milled stock produced increased from $644,284 in 1900 to $673,115 in 1901, a gain of $28,831.

Of the States producing slate California, Georgia, Maryland, and Virginia show a slight decrease; Maine, Minnesota, New Jersey, New York, Pennsylvania, and Vermont show an increase.

The following table shows the output of slate in the United States, by States, from 1897 to 1901:

Value of slate produced in the United States from 1897 to 1901.

State.	1897.	1898.	1899.	1900.	1901.
California	$7,000	$2,700	$6,642	$26,500	$18,608
Georgia	....	13,125	....	9,375	3,000
Maine	201,117	199,237	181,766	177,342	202,325
Maryland	53,939	82,240	93,595	128,673	105,798
Massachusetts	....	958	....	....	....
Minnesota	1,500	400	....	700	1,400
New Jersey	775	800	(a)	13,600	30,000
New York	53,799	48,694	76,675	62,755	100,960
Pennsylvania	2,365,299	2,491,756	2,537,022	2,713,598	2,984,264
Tennessee	....	....	(a)	250	....
Utah	....	....	(a)	....	....
Vermont	695,815	732,684	872,673	917,462	1,162,191
Virginia	145,370	150,946	183,110	190,211	178,979
Other States	....	....	11,250	....	....
Total	3,524,614	3,723,540	3,962,733	4,240,466	4,787,525

[a] Included in "Other States."

The following tables show the value of roofing and milled slate in the United States in 1900 and 1901, by States:

Value of roofing and mill slate in the United States in 1900 and 1901, by States.

1900.

State.	Roofing slate.	Value.	Other purposes than roofing, value.	Total value.
	Squares.			
California	3,500	$26,500		$26,500
Georgia	2,500	9,375		9,375
Maine	21,771	103,949	$73,393	177,342
Maryland	27,158	126,271	2,402	128,673
Minnesota			700	700
New Jersey	3,600	13,600		13,600
New York	7,713	58,360	4,395	62,755
Pennsylvania	788,571	2,277,192	436,406	2,713,598
Tennessee	50	250		250
Vermont	282,820	795,474	121,988	917,462
Virginia	56,365	185,211	5,000	190,211
Total	1,194,048	3,596,182	644,284	4,240,466

1901.

State.	Roofing slate.	Value.	Other purposes than roofing, value.	Total value.
	Squares.			
California	2,500	$18,608		$18,608
Georgia	800	3,000		3,000
Maine	20,791	111,295	$91,030	202,325
Maryland	20,153	104,781	1,017	105,798
Minnesota			1,400	1,400
New Jersey	7,500	30,000		30,000
New York	15,786	91,805	9,155	100,960
Pennsylvania	853,028	2,591,625	392,639	2,984,264
Vermont	330,191	984,317	177,874	1,162,191
Virginia	53,630	178,979		178,979
Total	1,304,379	4,114,410	673,115	4,787,525

The following table shows the average value of roofing slate per square since 1890:

Average annual price per square of roofing slate for the entire country.

1890	$3.34	1896	$3.36
1891	3.49	1897	3.09
1892	3.56	1898	3.42
1893	3.55	1899	3.14
1894	3.11	1900	3.01
1895	3.23	1901	3.15

EXPORTS.

The export trade in roofing slate, which rose so precipitately from a value of $780,112 in 1897 to a value of $1,370,075 in 1898, has been decreasing ever since. In 1901 the value of roofing slate exported, as shown in the figures from the Bureau of Statistics of the Treasury Department, was $898,262, a decrease of $52,281 from the value of $950,543, given in 1900. The chief exportation is to Great Britain, to which slate to the value of $727,088 was sent in 1901. In 1898 the value of roofing slate exported to Great Britain was $1,213,377. The cause of the decrease in exportation to Great Britain is the almost entire settlement of the big strikes in the old Welsh slate quarries and the opening and development of new quarries. Exports of slate to British Australia, which have been increasing for the last four years, are the next in value. The exportation to Denmark is next. It began in 1898 with $8,150 as the value of roofing slate exported, and this has since risen to $43,344. Most of this slate is shipped from New York, Philadelphia, Baltimore, and Boston.

The following table shows the ports and customs districts from which and to which slate has been exported since 1893:

Exports of slate from the United States, showing ports and customs districts from which and to which sent, from 1893 to 1901.

Port and customs district.	1893.	1894.	1895.	1896.	1897.	1898.	1899.	1900.	1901.
Baltimore, Md	......	......	......	$9,860	$101,581	$170,916	$99,083	$110,049	$135,571
Bangor, Me	......	$445	......	350	......	......	......	577	1,144
Boston and Charlestown, Mass	$1,086	......	$443	609	1,020	385	40,622	65,531	93,972
Newport News, Va	......	......	......	......	18,170	65,290	42,220	19,950	12,910
New York, N. Y	36,306	19,684	31,092	242,559	557,099	986,638	968,395	592,288	388,590
Passamaquoddy, Me	......	......	192	......	120	......	......	......	......
Philadelphia, Pa	......	......	......	2,300	94,865	136,916	205,779	150,254	236,090
Portland and Falmouth, Me	......	......	......	......	270	......	......	......	......
Brazos de Santiago, Tex.	5	......	......	......	......	......	14	......	......
Corpus Christi, Tex	......	......	105	174	......	1,761	......	......	......
New Orleans, La	......	587	......	......	......	......	......	......	......
Paso del Norte, Tex	......	621	......	......	......	......	......	......	......
Puget Sound, Wash	......	......	......	......	......	22	67	......	1,436
San Diego, Cal	......	......	......	......	......	......	7	......	......
Arizona	......	......	......	......	......	......	......	......	20
Buffalo Creek, N. Y	13,428	13,696	4,748	5,903	2,378	4,141	6,364	6,584	19,193
Champlain, N. Y	869	1,869	1,961	1,617	613	3,015	937	2,320	2,446
Detroit, Mich	......	......	65	2,874	2,427	854	129	1,441	380
Huron, Mich	200	......	......	......	......	......	......	424	......
Memphremagog, Vt	......	......	......	......	......	......	......	......	644
North and South Dakota.	94	160	......	......	......	137	......	612	942
Oswegatchie, N. Y	......	......	......	......	......	......	......	487	4,915
Vermont	24	133	200	139	1,569	......	......	26	9
Total	52,012	37,195	38,806	266,385	780,112	1,370,075	1,363,617	950,543	898,262
Belgium	......	......	......	......	......	......	524	......	......
France	......	......	......	12,000	......	......	......	......	......
Germany	......	......	25	910	5,850	82,916	65,974	17,921	5,180
Netherlands	......	......	......	......	2,087	25	520	......	600
United Kingdom	1,400	4,800	3,000	197,440	695,980	1,213,377	1,188,962	813,918	727,088
Denmark	......	......	......	......	......	8,150	25,323	25,437	43,344

Exports of slate from the United States, showing ports and customs districts, etc.—Cont'd.

Port and customs district.	1893.	1894.	1895.	1896.	1897.	1898.	1899.	1900.	1901.
Norway and Sweden	......	......	......	......	......	$270	$669	$859	$1,857
Bermuda	$1,046	$336	$1,550	$2,312	$1,395	157	230	202	3,222
Dominion of Canada:									
Nova Scotia, New Brunswick, etc.	119	445	406	1,278	730	......	288	798	1,269
Quebec, Ontario, etc.	14,615	15,858	6,974	10,533	6,977	8,147	7,430	11,894	27,587
British Columbia	......	......	......	......	......	22	67	......	2,378
Newfoundland and Labrador	32	......	13	......	......	......	......	30	......
Central American States:									
Guatemala	......	......	......	......	......	1,755	......	......	......
Honduras	......	587	......	......	......	......	......	......	......
Mexico	22	621	488	821	150	1,872	330	......	20
Miquelon, Langley, etc.	......	......	......	......	......	35	......	......	60
West Indies:									
British	......	3,803	4,419	1,159	1,860	2,356	1,400	2,049	1,067
Haiti	......	330	......	......	......	26	......	332	......
Santo Domingo	......	......	10	......	......	......	......	......	......
Cuba	......	2,643	3,258	90	......	673	16	......	......
Colombia	......	......	......	259	100	......	......	285	......
Guianas:									
British	......	712	702	440	165	600	......	......	......
Dutch	3,145	......	340	......	1,640	1,325	2,275	650	......
Peru	405	......	......	......	......	......	......	1,000	......
Uruguay	......	......	......	417	......	807	760	829	424
China	......	......	......	......	......	110	......	......	......
East Indies—British	......	......	......	1,628	810	550	......	......	......
British Australasia	30,362	7,060	17,363	34,970	60,604	44,642	64,434	71,881	79,319
Hawaiian Islands	......	......	......	245	166	......	77	......	......
British Africa	866	......	258	1,883	1,598	2,218	4,335	2,458	4,847
Portuguese Africa	......	......	......	......	......	42	3	......	......
Total	52,012	37,195	38,806	266,385	780,112	1,370,075	1,363,617	950,543	898,262

MARBLE.

The value of the marble produced increased from $4,267,253 in 1900 to $4,965,699 in 1901, or a gain of $698,446. There was an increase in the value of the marble sold in the rough, for building purposes, for ornamental work, and for interior work, but a decrease in the value for the cemetery work.

The increase in the value of marble sold in the rough was from $491,813 in 1900 to $591,667 in 1901, or $99,854. The increase in value of building marble was from $1,080,969 in 1900 to $1,236,023 in 1901, or $155,054. The increase in value for ornamental work was from $13,754 in 1900 to $126,576 in 1901, or $112,822. The increase in value for interior work was from $555,092 in 1900 to $1,008,482 in 1901, a gain of $453,390. The decrease in value for cemetery work was from $2,019,474 in 1900 to $1,948,892 in 1901, or $70,582. The value of marble used for purposes not included in the above tabulations decreased from $106,151 in 1900 to $54,059 in 1901.

New localities added to the producing list were Alaska, Utah, Oregon, and Arkansas, while Alabama and Colorado failed to report any production in 1901. These States, including Arizona and Montana, only quarried a very small amount for the purpose of local work, or to show the quality of their marble in samples. The operators in these States report good marble quarries, and are waiting for transportation facilities in order to put their product on the market. Alabama, Indian Territory, Kentucky, North Carolina, Virginia, and West Virginia have also quarries from which marketable marble has been obtained, and from which future reports may be expected.

The following table shows the value of the marble production in the United States from 1897 to 1901, inclusive, by States:

Value of marble, by States, from 1897 to 1901, inclusive.

State.	1897.	1898.	1899.	1900.	1901.
Alaska	....	....	....	....	$4,500
Alabama	....	....	....	$500	....
Arizona	....	....	....	5,000	300
Arkansas	....	....	$3,410	....	300
California	$48,690	$40,200	6,500	17,500	6,642
Colorado	99,600	....	10,776	....	....
Georgia	598,076	656,808	742,554	631,241	936,549
Idaho	5,000	4,400	....	1,250	....
Iowa	....	....	....	....	....
Maryland	130,000	120,525	77,000	70,000	68,100
Massachusetts	79,721	38,210	59,416	130,735	126,546
Missouri	....	....	....	900	2,100
Montana	....	....	....	1,200	1,500
New Mexico	....	....	....	4,500	10,600
New York	354,631	342,072	338,816	332,518	379,159
Oregon	....	....	....	....	500
Pennsylvania	62,683	39,373	139,506	151,167	157,547
Tennessee	441,954	316,814	[a] 384,705	424,054	494,637
Utah	....	....	2,355	....	320
Vermont	2,050,229	2,067,938	2,241,806	2,484,852	2,753,583
Washington	....	3,600	4,837	11,836	22,816
Total	3,870,584	3,629,940	4,011,681	4,267,253	4,965,699

[a] Contains small amount from North Carolina.

The following table shows the purposes for which the marble of the various producing States was sold by the quarrymen in 1900 and 1901.

Value of the marble product, by uses and States, 1900 and 1901.

1900.

State.	Rough.	Building.	Ornamental.	Cemetery.	Interior.	Other.	Total.
Alabama	$500	....	....	....	....	....	$500
Arizona	5,000	....	....	....	....	....	5,000
California	5,000	$4,400	$5,900	$2,200	....	....	17,500
Georgia	194,483	87,777	....	228,409	$104,322	$16,250	631,241
Idaho	250	....	....	1,000	....	....	1,250
Maryland	....	50,000	....	20,000	....	....	70,000
Massachusetts	5,950	107,604	....	300	10,961	5,920	130,735
Missouri	....	....	....	900	....	....	900
Montana	....	....	....	1,200	....	....	1,200
New Mexico	1,500	1,500	....	1,000	....	500	4,500
New York	51,480	102,904	....	164,331	....	13,803	332,518
Pennsylvania	16,056	114,533	....	10,003	8,000	2,575	151,167
Tennessee	88,284	36,750	....	70,250	228,770	....	424,054
Vermont	123,310	574,623	6,000	1,510,980	202,950	66,989	2,484,852
Washington	....	878	1,854	8,901	89	114	11,836
Total	491,813	1,080,969	13,754	2,019,474	555,092	106,151	4,267,253
1901.							
Alaska	$4,500	....	....	....	....	....	$4,500
Arizona	300	....	....	....	....	....	300
Arkansas	200	....	$100	....	....	....	300
California	3,280	$1,550	1,812	....	....	....	6,642
Georgia	268,761	241,683	16,500	$207,305	$166,300	$36,000	936,549
Maryland	8,100	45,000	....	15,000	....	....	68,100
Massachusetts	63,556	26,220	3,700	9,560	15,051	8,459	126.546
Missouri	....	....	....	2,100	....	....	2,100
Montana	....	....	....	1,500	....	....	1,500
New Mexico	4,200	3,000	300	3,100	....	....	10,600
New York	2,367	132,943	4,900	204,289	28,000	6,660	379,159
Oregon	....	....	....	500	....	....	500
Pennsylvania	18,078	111,069	....	25,060	400	2,940	157,547
Tennessee	162,513	13,000	....	14,000	305,124	....	494,637
Utah	320	....	....	....	....	....	320
Vermont	53,892	659,200	94,450	1,452,434	493,607	....	2,753,583
Washington	1,600	2,358	4,814	14,044	....	....	22,816
Total	591,667	1,236,023	126,576	1,948,892	1,008,482	54,059	4,965,699

The following table shows the various uses to which the marble quarried in 1897, 1898, 1899, 1900, and 1901 was put:

Distribution and value of output in 1897, 1898, 1899, 1900, and 1901 among various uses.

Use.	1897.	1898.	1899.	1900.	1901.
Sold by producers in rough state	$477,856	$690,240	$640,535	$491,813	$591,667
Sold for outside building	1,074,646	968,353	1,176,208	1,080,969	1,236,023
Ornamental purposes	9,010	23,904	92,942	13,754	126,576
Cemetery work (monuments and tombstones)	1,547,469	1,613,742	1,650,155	2,019,474	1,948,892
Interior decoration in buildings	576,983	304,714	389,040	555,092	1,008,482
Other uses	184,620	28,987	62,801	106,151	54,059
Total	3,870,584	3,629,940	4,011,681	4,267,253	4,965,699

LIMESTONE.

The total limestone production in the United States in 1901 was valued at $26,406,897, an increase of $6,052,878 over 1900, when the product was valued at $20,354,019. Of the 41 States reporting a limestone production in 1901, 35 reported an increased production. The States with the greatest production are, in order of rank, Pennsylvania, Indiana, Illinois, Ohio, New York, Missouri, and Wisconsin, This order of rank was the same in 1900. In 1901 each of the above States had a production valued at more than $1,000,000. In 1900 Wisconsin had a product of slightly less than $1,000,000. Indiana ranks first in the production of building stone, crushed stone, riprap, rubble, etc., and Pennsylvania stands first in the production of lime and flux.

The value of limestone produced for building work increased from $4,330,706 in 1900 to $5,219,310 in 1901, or $888,604. The total for building purposes includes $404,163 used for building railroad bridges. The value of limestone used for road material increased from $3,953,469 in 1900 to $5,271,642 in 1901, or $1,318,173. The total value of road material in 1901 includes railroad ballast, valued at $1,758,541; road-making material (macadam, etc.), valued at $2,298,286, and concrete, valued at $1,214,815. The production of riprap, rubble, etc., increased from $582,488 in 1900 to $1,024,109 in 1901. The value of the lime which decreased in 1900 in comparison with 1899, increased again in 1901. The value in 1900 was $6,797,496, in 1901 it was $8,204,054, a gain of $1,406,558. The value of stone used for blast-furnace flux increased from $3,687,394 in 1900 to $4,659,836 in 1901, or $972,442. This includes, as in 1900, stone sold by quarrymen to blast furnaces, and also limestone quarried by iron companies for their own use.

Under "stone used for other purposes," is included $570,882, which represents the value of the limestone used by Portland cement manufacturers. This is the first time that these figures have been collected.

The following table shows the production of limestone in the United States from 1897 to 1901, by States:

Value of limestone from 1897 to 1901, by States.

State.	1897.	1898.	1899.	1900.	1901.
Alabama	$221,811	$242,295	$364,636	$533,608	$619,423
Arizona	11,522	1,782	960	165	300
Arkansas	44,222	54,373	71,965	71,407	68,319
California	308,925	229,729	287,295	407,489	645,455
Colorado	79,256	109,310	96,456	160,587	245,799
Connecticut	178,410	142,057	162,388	148,060	140,424
Florida	18,889	91,330	44,002	128,381	51,870
Georgia	32,000	57,803	29,786	54,451	85,629
Idaho	15,538	3,080	3,325	34,587	21,251
Illinois	1,483,157	1,421,072	2,065,483	1,881,151	2,793,837
Indiana	2,012,608	1,686,572	2,173,833	2,344,818	2,993,186
Iowa	480,572	524,546	785,576	586,410	777,484
Kansas	208,889	305,605	379,001	339,466	478,986
Kentucky	40,815	83,960	178,861	178,252	199,567
Maine	742,877	1,283,468	1,028,375	691,312	715,272
Maryland	181,637	433,653	235,225	317,207	382,381
Massachusetts	126,508	174,822	168,147	209,359	244,039
Michigan	215,177	271,523	371,210	425,636	565,931
Minnesota	236,397	345,685	496,462	441,554	522,778
Missouri	1,018,202	735,275	977,399	1,079,343	1,362,272
Montana	37,300	63,196	113,718	141,093	143,866
Nebraska	42,359	78,493	125,017	107,305	154,717
New Jersey	141,646	146,611	153,025	170,006	309,738
New York	1,697,780	1,533,936	1,545,699	1,730,162	1,738,716
North Carolina [a]	....	1,605	....	....	8,266
Ohio	1,486,550	1,673,160	1,793,604	1,969,387	2,606,502
Oklahoma	....	3,000	50,550	25,586	32,497
Oregon	....	7,480	8,000	10,900	24,520
Pennsylvania	2,327,870	2,746,256	3,088,583	3,800,318	5,081,387
Rhode Island	11,555	10,215	18,239	16,828	38,030
South Carolina	30,000	34,000	17,650	38,415	28,500
South Dakota	3,895	26,858	45,808	47,762	53,780
Tennessee	113,774	182,402	208,097	238,505	330,927
Texas	57,258	70,321	100,025	124,728	209,658
Utah	9,250	11,721	6,381	12,749	78,900
Vermont	165,657	174,150	282,173	188,100	205,138
Virginia	192,972	182,852	255,640	403,318	[b] 986,177
Washington	126,877	140,239	139,339	249,163	234,587
West Virginia	61,546	56,167	58,802	53,701	([c])
Wisconsin	641,232	698,454	826,486	989,685	1,225,448
Wyoming	....	....	742	3,065	1,340
Total	14,804,933	16,039,056	18,757,963	20,354,019	26,406,897

[a] Small amounts for 1899 and 1900 are included with South Carolina.

[b] Includes West Virginia.

[c] Included in Virginia.

The following tables show the value of the limestone production in 1900 and 1901, by States and uses:

Production of limestone in the United States in 1900 and 1901, by States and uses.

1900.

State or Territory.	Building purposes.	Paving and road making.	Riprap.	Made into lime.	Stone sold to lime burners.	Flux.	Other purposes.	Total.
Alabama	$83,380	....	$14,697	$139,090	....	$296,241	$200	$533,608
Arizona	165	....	....	....	....	....	....	165
Arkansas	5,994	$665	....	64,038	$200	....	510	71,407
California	1,937	87,128	325	297,810	316	1,080	18,893	407,489
Colorado	....	1,274	....	96,055	75	62,413	770	160,587
Connecticut	....	25	....	145,490	....	2,545	....	148,060
Florida	....	6,988	97,023	24,370	....	....	....	128,381
Georgia	1,200	10,735	....	39,492	2,000	1,024	....	54,451
Idaho	....	9,000	....	25,587	....	....	....	34,587
Illinois	499,739	859,602	96,900	246,575	....	114,849	63,486	1,881,151
Indiana	1,639,985	239,913	11,451	227,343	....	168,692	57,434	2,344,818
Iowa	248,883	153,929	58,493	110,589	580	....	13,936	586,410
Kansas	203,304	113,952	7,586	3,192	1,125	....	10,307	339,466
Kentucky	21,623	115,730	12,500	8,393	....	17,728	2,278	178,252
Maine	....	....	....	629,545	4,218	883	56,666	691,312
Maryland	11,385	14,343	524	281,717	3,726	3,867	1,645	317,207
Massachusetts	8,175	....	....	199,645	....	1,539	....	209,359
Michigan	32,362	105,266	799	94,789	65,000	3,200	124,220	425,636
Minnesota	323,688	27,778	32,912	42,480	400	300	13,996	441,554
Missouri	362,344	235,489	57,023	398,010	....	8,288	18,189	1,079,343
Montana,	3,000	2,093	....	19,000	....	117,000	....	141,093
Nebraska	39,556	31,442	10,488	590	7,088	13,125	5,016	107,305
New Jersey	6,955	1,299	1,000	105,902	286	54,564	....	170,006
New York	244,738	484,902	21,668	676,324	40,838	71,408	190,284	1,730,162
Ohio	217,399	466,819	47,530	661,869	14,939	422,407	138,424	1,969,387
Oklahoma	2,672	22,914	....	....	....	....	....	25,586
Oregon	....	....	....	10,525	375	....	....	10,900
Pennsylvania	128,997	684.983	660	910,903	21,799	1,949,859	103,117	3,800,318
Rhode Island	....	....	....	16,715	....	113	....	16,828
South Carolina[a]	....	500	....	36,320	....	1,595	....	38,415
South Dakota	300	....	....	14,380	....	33,082	....	47,762
Tennessee	22,800	26,490	396	128,035	120	60,564	100	238,505
Texas	15,681	9,821	250	79,659	....	18,942	375	124,728
Utah	11,979	....	....	770	....	....	....	12,749
Vermont	193	32	....	187,075	....	....	800	188,100
Virginia	5,070	8,721	....	151,687	....	237,840	....	403,318
Washington	....	240	....	239,022	....	6,643	3,258	249,163
West Virginia	9,391	40	....	36,677	5,851	1,742	....	53,701
Wisconsin	177,386	231,356	110,263	445,193	3,630	15,861	5,996	989,685
Wyoming	425	....	....	2,640	....	....	....	3,065
Total	4,330,706	3,953,469	582,488	6,797,496	172,566	3,687,394	829,900	20,354,019

[a] Includes North Carolina.

Production of limestone in the United States in 1900 and 1901, etc.—Continued.

1901.

State or Territory.	Building purposes.	Flagging and curbing.	Riprap rubble, etc.	Crushed stone.		
				Road making.	Railroad ballast.	Concrete, etc.
Alabama	$42,695	....	$225	....	....	$2,500
Arkansas	3,466	$1,020	320	$1,000	....	....
California	1,500	....	6,366	145,225	$60,900	5,023
Colorado	....	....	3,141	100	....	....
Florida	....	....	6,250	3,670	2,750	....
Georgia	3,000	....	....	....	9,860	3,721
Idaho	100	....	520	....	....	25
Illinois	384,949	101,410	477,435	452,143	478,452	225,151
Indiana	2,123,237	149,363	61,526	181,696	29,042	15,002
Iowa	272,501	8,117	85,342	83,055	30,562	70,285
Kansas	290,730	16,872	27,147	14,329	107,904	15,050
Kentucky	59,425	10,697	5,500	60,423	29,622	9,370
Maryland	14,138	1,796	420	43,887	8,000	1,776
Massachusetts	7,224	....	453	....	....	150
Michigan	47,785	380	5,098	31,605	18,200	75,643
Minnesota	375,308	20,773	39,477	17,918	200	2,150
Missouri	377,146	73,197	56,345	105,435	116,293	73,742
Montana	7,336	30	1,000	....	....	....
Nebraska	44,015	810	26,312	10,904	5,025	51,380
New Jersey	2,460	61	750	1,275	650	....
New York	265,024	5,055	13,997	188,277	146,077	293,530
North Carolina	....	....	....	4,668	....	....
Ohio	341,389	13,869	41,451	489,940	299,599	64,347
Oklahoma	4,147	2,716	600	9	24,525	....
Oregon	....	....	....	12,000	....	100
Pennsylvania	192,972	7,321	29,291	221,032	273,260	252,603
South Carolina	....	....	....	1,000	....	....
South Dakota	225	....	....	....	....	....
Tennessee	40,258	775	2,915	1,760	35,425	4,935
Texas	45,630	3,117	7,215	3,900	....	5,350
Utah	6,629	....	....	23	....	....
Vermont	64	....	....	610	....	....
Virginia[a]	2,270	25	27,650	225	75,695	2,065
Washington	....	....	....	....	....	840
West Virginia	....	....	....	....	....	....
Wisconsin	263,687	46,571	97,213	222,177	6,500	40,052
Wyoming	....	....	100	....	....	25
Total	5,219,310	463,925	1,024,109	2,298,286	1,758,541	1,214,815

[a] Includes West Virginia.

Production of limestone in the United States in 1900 and 1901, etc.—Continued.

1901—Continued.

State or Territory.	Lime.	Sold to lime burners.	Flux.	Other purposes.	Total.
Alabama	$201,586	$150	$354,267	$18,000	$619,423
Arizona	300	....	....	....	300
Arkansas	62,163	350	....	....	68,319
California	343,625	2,836	47,830	32,150	645,455
Colorado	102,466	4,480	121,839	13,773	245,799
Connecticut	139,374	38	1,012	....	140,424
Florida	39,150	50	....	....	51,870
Georgia	65,888	....	3,160	....	85,629
Idaho	20,606	....	....	....	21,251
Illinois	504,018	....	103,729	66,550	2,793,837
Indiana	223,340	1,200	193,469	15,311	2,993,186
Iowa	221,760	....	....	5,862	777,484
Kansas	6,350	....	....	604	478,986
Kentucky	12,290	....	6,998	5,242	199,567
Maine	709,251	500	5,521	....	715,272
Maryland	307,657	4,007	700	....	382,381
Massachusetts	234,261	....	1,843	108	244,039
Michigan	136,160	136,173	13,488	101,399	565,931
Minnesota	57,277	....	....	9,675	522,778
Missouri	546,549	....	7,607	5,958	1,362,272
Montana	22,250	....	113,250	....	143,866
Nebraska	500	4,281	10,640	850	154,717
New Jersey	62,707	1,708	40,587	199,540	309,738
New York	631,358	46,327	16,190	132,881	1,738,716
North Carolina	3,598	....	....	....	8,266
Ohio	726,883	24,822	550,346	53,856	2,606,502
Oklahoma	....	....	....	500	32,497
Oregon	12,420	....	....	....	24,520
Pennsylvania	1,249,996	151,104	2,243,692	460,116	5,081,387
Rhode Island	37,798	....	232	....	38,030
South Carolina	27,500	....	....	....	28,500
South Dakota	13,830	....	39,725	....	53,780
Tennessee	181,219	....	62,640	1,000	330,927
Texas	93,587	....	50,294	565	209,658
Utah	36,910	....	34,588	750	78,900
Vermont	204,400	....	64	....	205,138
Virginia[a]	230,810	8,758	595,929	42,750	986,177
Washington	210,341	6,192	16,514	700	234,587
West Virginia	....	....	....	....	(a)
Wisconsin	522,661	....	23,682	2,905	1,225,448
Wyoming	1,215	....	....	....	1,340
Total	8,204,054	392,976	4,659,836	1,171,045	26,406,897

[a] Included in Virginia.

CLAY-WORKING INDUSTRIES.

By Jefferson Middleton.

INTRODUCTION.

With the exception of the section on clay production, this report deals with the products of the clay-working industries and hence the tables are made up to show the products of clay and not the production of clay.

The year under review, 1901, was one of the most prosperous in the building trades, and the effect of this prosperity is shown in the great increase in the building-brick production and in the statistics of building operations shown on page 7. The year began with bright prospects, which were probably more than realized, and with the exception of the draintile trade, which was more or less affected by the drought in the central West, was one of unprecedented activity. The large demand was felt at the beginning of the season, and by early summer there was in many localities almost a brick famine, manufacturers frequently being compelled to refuse orders. Notwithstanding this enormous demand, and contrary to the general law of supply and demand, the price of brick advanced but slightly, as is shown in this report. The brickmakers were wise in maintaining the lower prices, as these probably tended to prevent a large increase in the number of new yards, thus cutting off much competition, not only for the time being, but for the future. The number of firms reporting brick and tile production decreased from 5,914 in 1900 to 5,887 in 1901, a decrease of 27, or .45 of one per cent, but the product reported by these operators increased from $76,413,775 in 1900 to $87,747,727 in 1901, a gain of $11,333,952, or 14.83 per cent. It thus appears that while the number of producers of brick and tile decreased slightly, the product increased largely.

The use of burned clay as a building material is becoming more and more general. This popularity is due to its permanence, its adaptability to all sorts and conditions of buildings, from the commonest structure to the most ornate building composed largely of enameled terra cotta, its ready adaptability to all requirements of form and color, its fireproof qualities, its cheapness, and the exhaustion and consumption of the forests. Though all this is common knowledge, the public is slow to realize it. But the time will come when clay products will receive the recognition due them by the public in general and by the architects. Undoubtedly the effect produced by the ceramic schools for technical training already established in several States—and several others are contemplating the early establishment of similar schools—in graduating scientific clay workers, will be to improve clay wares and extend their uses.

The statistics of this report are probably the most accurate ever compiled of the great industry with which they are concerned. Although they are not so comprehensive in scope as those collected by the Census Office, the foregoing statement is correct in respect to the figures of production. There is scarcely a plant in the country whose yearly product is valued as high as $10,000 that has not responded to the request for information. Especially is this true of the pottery industry, the figures of which are almost absolutely complete, every plant in the country making white ware, with one exception, having reported and a close estimate has been made for that plant

ACKNOWLEDGMENTS.

The publication of these figures would have been impossible without the cooperation of the clay workers of the country, to whom cordial thanks are hereby tendered, especially for the promptness with which they responded, making possible the issuance of the report fully a month in advance of that of any previous report on the subject by this office. Mr. D. V. Purington has again been of material assistance in securing returns for Cook County, Ill., and the thanks of the writer are extended to him for this aid. Thanks are also extended to the officials in many of the cities who have supplied the information concerning the building operations of the principal cities of the country, as shown on page 7.

As in previous years, the State geological surveys of Iowa and Maryland have cooperated in the collection of the figures for their States, and in 1901 the State geological survey of North Carolina also cooperated in the collection of statistics. The complete returns for these States are due to the efforts of the officers of the different State geological surveys.

BUILDING OPERATIONS.

The following table shows the number of building permits issued and the value of the buildings erected under these permits in the leading cities of the United States in 1900 and 1901, and illustrates the large increase in the building operations of the cities enumerated. Requests were sent to the building authorities of 55 of the largest cities of the country for this information, 42 of which responded, as shown in the table. Portland, Oreg., reported that no records of the kind are kept in that city, while Paterson, N. J., reported the loss of its records in the recent fire, hence no report could be made; Toledo, Ohio, and Wheeling, W. Va., were unable to furnish figures.

Although these figures include all sorts of buildings and repairs, it being impracticable to separate the different classes of buildings and repairs, it may be assumed that in the larger cities at least the buildings are almost entirely of brick or stone; in the smaller cities undoubtedly wooden buildings form a considerable proportion of those reported.

Building operations in the leading cities of the United States in 1900 and 1901.

Cities.	1900.		1901.	
	Number of permits.	Cost of buildings.	Number of permits.	Cost of buildings.
Allegheny, Pa	583	$1,322,800	666	$1,510,750
Atlanta, Ga	2,079	1,983,144	2,695	2,852,148
Boston, Mass	1,852	12,844,125	1,023	12,923,059
Brooklyn, N. Y[a]	3,019	16,499,582	3,377	18,198,617
Buffalo, N. Y	1,071	3,514,028	1,058	4,338,771
Cambridge, Mass	455	2,266,615	567	1,664,390
Chicago, Ill	3,554	19,100,050	6,053	34,962,075
Cincinnati, Ohio	2,350	2,145,035	2,669	3,505,450
Cleveland, Ohio	2,692	3,845,833	3,036	6,235,782
Columbus, Ohio	910	1,458,974	1,139	1,934,827
Dayton, Ohio	780	1,452,500	1,048	905,283
Denver, Colo.[b]	1,001	2,388,443	1,553	4,011,945
Des Moines, Iowa	514	1,093,501	676	1,658,987
Detroit, Mich	1,964	4,134,300	2,764	5,961,600
Grand Rapids, Mich	379	608,004	579	891,984
Hartford, Conn	651	2,551,700	733	2,612,100
Indianapolis, Ind	2,291	2,266,216	2,546	3,744,969
Jersey City, N. J	314	1,768,511	492	1,803,823
Kansas City, Mo	1,111	3,267,000	1,477	4,370,090
Los Angeles, Cal	1,922	2,519,451	2,826	4,376,917
Louisville, Ky	1,050	1,674,603	1,451	1,755,505
Memphis, Tenn	1,940	1,885,950	2,357	2,865,295
Milwaukee, Wis	1,170	3,114,158	1,484	5,024,695
Minneapolis, Minn	3,006	3,943,774	3,317	6,020,967
Newark, N. J	980	4,041,220	1,189	8,933,227
New Haven, Conn	309	1,542,885	260	1,674,010
New Orleans, La	1,377	1,317,493	1,797	2,247,191
New York, N. Y.[c]	6,278	78,291,544	7,657	136,051,697
Omaha, Nebr	683	992,845	640	1,196,699
Philadelphia, Pa	8,439	20,778,970	8,713	29,519,710
Pittsburg, Pa	2,378	10,394,201	3,092	17,911,682
Providence, R. I	639	3,485,550	793	4,028,575
Reading, Pa	321	786,520	627	1,272,050
Rochester, N. Y	469	1,439,222	592	1,868,571
St. Joseph, Mo	731	112,458	835	1,020,797
St. Louis, Mo	2,513	5,916,984	3,722	13,207,991
St. Paul, Minn.[d]	1,039	1,690,302	1,373	4,261,400
Scranton, Pa	546	991,552	614	1,776,768
Seattle, Wash	2,960	3,263,022	5,864	4,569,268
Syracuse, N. Y	808	1,583,023	726	1,624,443
Washington, D. C	892	5,826,794	1,057	5,106,031
Worcester, Mass	397	1,413,703	434	1,773,492
Total	68,417	241,516,585	85,571	372,173,631

[a] Figures for Brooklyn cover Borough of Brooklyn only.
[b] Figures for 1900 from Denver are for ten months.
[c] Figures for New York cover Borough of Manhattan only.
[d] Includes $616,520 in 1900 and $948,989 in 1901 expended on public buildings, both State and Federal.

From this table it will be seen that the forty-two cities reporting show that the number of permits issued in 1901 was 85,571, as compared with 68,417 in 1900, a gain of 17,154, or 25.07 per cent. The value of the buildings erected on these permits rose from $241,516,585 in 1900 to $372,173,631 in 1901, a gain of $130,657,046, or 54.09 per cent. The average value of the buildings, assuming that one permit was issued for each building, was $3,530 in 1900 and $4,349 in 1901.

Although the city of New York was first in the value of its buildings in 1901 with $136,051,697, the number of permits was 1,056 less than those of Philadelphia, where the value of the buildings was $29,519,710, and 1,604 more than in Chicago, where the value of the buildings was $34,962,075. The average value of the buildings erected in New York in 1901 was $17,768, in Chicago $5,776, and in Philadelphia $3,388.

PRODUCTION.

The following tables give the total values of the products of clay in the United States in 1900 and 1901, by States and Territories:

Value of the products of clay in the United States in 1901.

State.	Brick and tile.	Pottery.	Total.
Alabama	$928,429	$18,362	$946,791
Arizona	92,986		92,986
Arkansas	395,858	11,405	407,263
California	1,735,721	33,434	1,769,155
Colorado	1,568,167	26,700	1,594,867
Connecticut	[a]1,039,709	[b]91,200	[a]1,130,909
Delaware	131,164		131,164
District of Columbia	311,129	12,879	324,008
Florida	190,674	([c])	190,674
Georgia	1,527,853	17,230	1,545,083
Hawaii	([d])		([d])
Idaho	68,328		68,328
Illinois	8,960,041	682,449	9,642,490
Indiana	3,935,083	531,371	4,466,454
Indian Territory	117,224		117,224
Iowa	2,711,305	26,520	2.737,825
Kansas	981,020	([c])	981,020
Kentucky	1,374,846	139,697	1,514,543
Louisiana	612,595	3,108	615,703
Maine	734,678	([c])	734,678
Maryland	1,272,175	333,480	1,605,655
Massachusetts	1,589,469	281,368	1,870,837
Michigan	1,497,169	44,865	1,542,034
Minnesota	1,256,552	292,095	1,548,647
Mississippi	451,694	4,779	456,473
Missouri	4,409,906	64,647	4,474,553
Montana	539,221	([c])	539,221
Nebraska	806,473		806,473
Nevada	17,625		17,625
New Hampshire	765,964	([c])	765,964
New Jersey	5,781,805	5,900,073	11,681,878
New Mexico	81,345		81,345
New York	7,214,358	1,077,360	8,291,718
North Carolina	751,301	20,037	771,338
North Dakota	76,708		76,708
Ohio	11,526,424	10,048,561	21,574,985
Oklahoma	205,060		205,060
Oregon	[e]263,891	([c])	[e]263,891
Pennsylvania	13,656,730	1,665,012	15,321,742
Rhode Island	([f])		([f])
South Carolina	563,346	11,872	575,218
South Dakota	59,365		59,365
Tennessee	829,874	64,093	893,967
Texas	1,632,189	91,186	1,723,375
Utah	291,189	([c])	291,189
Vermont	77,554		77,554
Virginia	1,435,300	4,047	1,439,347
Washington	927,298	17,500	944,798
West Virginia	1,087,838	858,642	1,946,480
Wisconsin	1,234,144	13,400	1,247,544
Wyoming	28,950		28,950
Other States		[g]76,488	[g]76,488
Total	87,747,727	22,463,860	110,211,587
Per cent of total	79.62	20.38	100.00

[a] Includes Rhode Island.

[b] Produced by Connecticut alone.

[c] Included in "Other States."

[d] Included in Oregon.

[e] Includes Hawaii.

[f] Included in Connecticut.

[g] Comprising pottery totals for the following States: Florida, Kansas, Maine, Montana, New Hampshire, Oregon, and Utah. This total could not be distributed among the States to which it belongs without disclosing the operations of individual establishments.

Value of the products of clay in the United States in 1900.

State.	Brick and tile.	Pottery.	Total.
Alabama	$692,431	$20,296	$712,727
Arizona	112,737	...	112,737
Arkansas	354,732	26,280	381,012
California	1,351,611	24,387	1,375,998
Colorado	1,182,575	[a]17,944	1,200,519
Connecticut and Rhode Island	1,038,722	61,250	1,099,972
Delaware	156,274	...	156,274
District of Columbia	278,060	10,873	288,933
Florida	140,604	(b)	140,604
Georgia	1,168,835	[b]24,383	1,193,218
Idaho	49,382	(a)	49,382
Illinois	6,932,086	776,773	7,708,859
Indiana	3,532,450	[c]325,900	3,858,350
Indian Territory	30,233	...	30,233
Iowa	2,254,662	36,589	2,291,251
Kansas	1,002,689	14,061	1,016,750
Kentucky	1,349,827	131,497	1,481,324
Louisiana	503,394	4,300	507,694
Maine	724,934	(d)	724,934
Maryland	1,275,239	436,617	1,711,856
Massachusetts	1,594,377	[d]238,724	1,833,101
Michigan	1,147,378	34,317	1,181,695
Minnesota	1,103,302	[e]293,395	1,396,697
Mississippi	558,916	14,452	573,368
Missouri	3,665,093	71,474	3,736,567
Montana	350,489	(a)	350,489
Nebraska	683,958	...	683,958
Nevada	9,580	...	9,580
New Hampshire	485,013	(f)	485,013
New Jersey	5,664,772	[f]5,263,651	10,928,423
New Mexico	41,898	...	41,898
New York	6,495,281	[g]1,165,325	7,660,606
North Carolina	797,112	18,863	815,975
North Dakota	92,399	...	92,399
Ohio	9,731,305	[h]8,573,323	18,304,628
Oklahoma	164,457	...	164,457
Oregon	264,095	17,290	281,385
Pennsylvania	12,000,875	1,390,873	13,391,748
Rhode Island	(i)	...	...
South Carolina	693,703	17,633	711,336
South Dakota	43,440	...	43,440
Tennessee	865,923	49,655	915,578
Texas	1,083,553	87,464	1,171,017
Utah	227,621	6,600	234,221
Vermont	121,041	...	121,041
Virginia	1,302,085	3,110	1,305,195
Washington	616,029	9,430	625,459
West Virginia	1,384,924	631,841	2,016,765
Wisconsin	1,072,179	(e)	1,072,179
Wyoming	21,500	...	21,500
Total	76,413,775	19,798,570	96,212,345
Per cent of total	79.42	20.58	100.00

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[a] Value of the pottery products of Idaho and Montana is included with that of Colorado.
[b] Value of the pottery products of Florida is included with that of Georgia.
[c] Porcelain electrical supplies for Indiana included in New York.
[d] Value of the pottery products of Maine is included with that of Massachusetts.
[e] Value of the pottery products of Wisconsin is included with that of Minnesota.
[f] Value of pottery products of New Hampshire is included with that of New Jersey.
[g] Includes porcelain electrical supplies for Indiana and china for Ohio.
[h] China for Ohio included in New York.
[i] Included with Connecticut.

These tables show that the value of the products of clay in the United States as reported to this office was $110,211,587 in 1901, as compared with $96,212,345 in 1900, a gain of $13,999,242, or 14.55 per cent. This is one of the largest gains in the industry recorded by this office. The gain for 1899 over 1898 exceeded it by about $7,000,000, but the figures for 1899 are those collected by the Twelfth Census and include items not contained in the figures collected and published by this office, as explained in the report for 1900, hence this great difference is more apparent than real, and the figures for 1899 probably do not represent the real condition of the clay-working industry for that year. The same reason explains the apparently small increase in 1900 over 1899, when the gain was only $414,975, or less than one-half of 1 per cent, the production in 1899 being valued at $95,797,370.

Of this total of $110,211,587, $87,747,727, or 79.62 per cent, represents the value of the products classified in our inquiry card as "brick and tile;" but this class really embraces all structural clay products, together with paving brick and products used in drainage, and other of the clay products which it is impracticable to classify separately; and $22,463,860, or 20.38 per cent, was the value of the pottery products.

The following table gives the total values of the products of clay in the United States from 1896 to 1901, by States:

Value of the products of clay in the United States, 1896 to 1901, inclusive. (*a*)

State.	1896.	1897.	1898.	1899.	1900.	1901.
Alabama	$372,185	$443,378	$456,597	$897,810	$712,727	$946,791
Arizona	55,663	54,143	81,509	101,954	112,737	92,986
Arkansas	216,332	184,099	245,766	339,142	381,012	407,263
California	680,207	703,410	1,263,734	1,587,518	1,375,998	1,769,155
Colorado	328,680	406,863	766,767	1,071,388	1,200,519	1,594,867
Connecticut and Rhode Island	1,448,598	1,336,670	952,180	1,074,202	1,099,972	1,130,909
Delaware	61,003	68,458	160,555	168,485	156,274	131,164
District of Columbia	353,565	288,981	320,320	481,145	288,933	324,008
Florida	122,144	89,435	130,987	138,808	140,604	190,674
Georgia	905,813	962,513	857,258	1,263,995	1,193,218	1,545,083
Idaho	16,000	15,914	27,365	47,624	49,382	68,328
Illinois	5,938,247	5,498,574	6,866,715	7,259,825	7,708,859	9,642,490
Indiana	2,674,325	2,712,309	3,331,997	4,235,354	3,858,350	4,466,454
Indian Territory	(*b*)	14,135	35,633	35,075	30,233	117,224
Iowa	1,694,402	1,821,247	2,183,022	2,233,808	2,291,251	2,737,825
Kansas	260,087	256,518	444,975	839,767	1,016,750	981,020
Kentucky	829,684	806,368	1,000,940	1,358,428	1,481,324	1,514,543
Louisiana	402,412	370,910	517,059	554,729	507,694	615,703
Maine	994,731	800,739	600,029	662,685	724,934	734,678
Maryland	1,450,055	1,305,282	1,542,853	1,679,641	1,711,856	1,605,655
Massachusetts	2,264,974	2,179,396	1,809,070	2,181,710	1,833,101	1,870,837
Michigan	1,005,405	791,870	1,043,362	1,283,997	1,181,695	1,542,034
Minnesota	696,701	882,069	1,132,584	1,218,697	1,396,697	1,548,647
Mississippi	224,809	275,600	321,783	546,741	573,368	456,473
Missouri	2,810,245	2,536,528	3,112,716	3,666,616	3,736,567	4,474,553
Montana	276,311	231,649	275,026	314,340	350,489	539,221
Nebraska	144,373	351,385	513,565	843,315	683,958	806,473
Nevada				17,850	9,580	17,625
New Hampshire	598,169	465,172	439,189	570,287	485,013	765,964
New Jersey	4,728,003	6,180,847	8,706,357	10,787,273	10,928,423	11,681,878
New Mexico	(*b*)	33,270	41,940	108,090	41,898	81,345
New York	6,414,206	5,615,504	6,622,537	8,076,412	7,660,606	8,291,718
North Carolina	420,899	369,194	429,782	774,202	815,975	771,338
North Dakota	59,625	62,420	72,900	168,124	92,399	76,708
Ohio	10,609,571	11,067,684	12,667,627	16,500,625	18,304,628	21,574,985
Oklahoma	[b] 38,444	30,217	78,258	150,552	164,457	205,060
Oregon	126,345	115,798	131,864	327,374	281,385	263,891
Pennsylvania	9,063,829	7,874,695	9,714,683	14,103,245	13,391,748	15,321,742
South Carolina	354,275	290,497	259,232	605,329	711,336	575,218
South Dakota	53,004	21,800	30,770	46,500	43,440	59,365
Tennessee	537,325	612,293	520,038	948,853	915,578	893,967
Texas	915,753	1,197,039	817,797	1,221,119	1,171,017	1,723,375
Utah	137,573	135,781	180,992	216,449	234,221	291,189
Vermont	83,274	53,485	59,474	131,525	121,041	77,554
Virginia	883,536	812,046	894,383	1,093,784	1,305,195	1,439,347
Washington	161,528	190,720	250,988	591,277	625,459	944,798
West Virginia	899,444	1,115,254	1,098,575	1,451,539	2,016,765	1,946,480
Wisconsin	788,995	724,282	877,306	1,811,712	1,072,179	1,247,544
Wyoming	9,659	3,550	3,825	8,450	21,500	28,950
Other States						[c] 76,488
Total	63,110,408	62,359,991	73,892,884	95,797,370	96,212,345	110,211,587
Operating firms reporting	5,293	5,424	5,971	6,962	6,475	6,421

[a] In 1897 and 1898 the figures for California include the pottery products of Oregon and Washington; Colorado, those of Idaho, Montana, Nebraska, and Utah; Maryland, those of the District of Columbia; Georgia, those of Florida; Mississippi, those of Louisiana; New Hampshire, those of Maine; Minnesota, those of Wisconsin; and North Carolina, those of South Carolina. This is done in order that the operation of individual establishments may not be disclosed.

[b] The figures for Indian Territory and New Mexico in 1896 are included with Oklahoma.

[c] Comprising pottery totals for the following States: Florida, Kansas, Maine, Montana, New Hampshire, Oregon, and Utah. This total could not be distributed among the States to which it belongs without disclosing the operations of individual establishments.

The foregoing table shows the value of the products of clay by States for six years, together with the number of firms reporting, and is a condensed statement of the industry by States for the period covered.

It will be observed from this table that, notwithstanding the manifest prosperity of the industry in 1901, twelve States show a decrease in the value of their product as compared with that of 1900. The States showing decreases are not confined to any one region, though of the twelve States, eight are located in the southern and eastern part of the country, and five are southern States. The States showing a decrease are: Arizona, Delaware, Kansas, Maryland, Mississippi, North Carolina, North Dakota, Oregon, South Carolina, Tennessee, Vermont, and West Virginia. These decreases were small, the largest being that of South Carolina, where it amounted to $136,118, or about 20 per cent. The smallest decrease was that of North Dakota—$15,691, or about 17 per cent.

The following table gives a comparison of the several varieties of products of clay made in 1900 and 1901, showing the actual gain or loss, together with the percentage of gain or loss:

Value of the products of clay in the United States in 1900 and 1901, with increase or decrease.

Product.	1900.	1901.	Increase in 1901.	Percentage of increase in 1901.
Common brick	$38,621,514	$45,503,076	$6,881,562	17.82
Front brick	3,864,670	4,709,737	845,067	21.87
Vitrified paving brick	4,764,124	5,484,134	720,010	15.11
Fancy or ornamental brick	289,698	372,131	82,433	28.45
Enameled brick	323,630	463,709	140,079	43.28
Fire brick	9,830,517	9,870,421	39,904	.41
Stove linings	462,541	[a] 423,371	[b] 39,170	[b] 8.47
Drain tile	2,976,281	3,143,001	166,720	5.60
Sewer pipe	5,842,562	6,736,969	894,407	15.31
Ornamental terra cotta	2,372,568	3,367,982	995,414	41.95
Fireproofing	1,820,214	1,860,269	40,055	2.20
Tile (not drain)	2,349,420	2,867,659	518,239	22.06
Miscellaneous	2,896,036	2,945,268	49,232	1.70
Total brick and tile	76,413,775	87,747,727	11,333,952	14.83
Total pottery	19,798,570	22,463,860	2,665,290	13.46
Total	96,212,345	110,211,587	13,999,242	14.55

[a] Stove linings for Vermont in 1901 included in Vermont miscellaneous.

[b] Decrease.

The foregoing table exhibits in a most graphic way the prosperous condition of all of the branches of the industry during the year 1901. It will be noticed that in only one branch, and that a minor one—stove linings—was a decrease noted from the already large production of 1900. This is the first time since this office began the collection of statistics relating to this industry that such a satisfactory condition has existed, except possibly in 1899.

The year 1901 was one of unprecedented activity in the building-brick industry, the total value of brick used for this purpose being $51,048,653, as compared with $43,099,512 in 1900, an increase of $7,949,141, or 18.44 per cent; with $45,461,025 in 1899, and with $35,191,454 in 1898. The common-brick product increased in value from $38,621,514 in 1900 to $45,503,076 in 1901, a gain of $6,881,562, or 17.82 per cent. In 1900 this product declined $1,266,008, or 3.17 per cent. It is evident, therefore, that the common-brick industry was in a remarkably prosperous condition during 1901. Although the actual gain in the other varieties of structural brick would not be expected to equal that of common brick, the proportional gain in the front brick was even greater in 1901 than that of the common product, the production increasing 21.87 per cent, from $3,864,670 in 1900 to $4,709,737 in 1901, a gain of $845,067, which indicates a wider use of this product. The other varieties of structural brick made very satisfactory gains, and enameled brick made the greatest proportional gain of all the clay products, i. e., 43.28 per cent.

The vitrified paving-brick industry has shown a steady increase in value of product from 1897, when it was $3,582,037, to 1901, when it was $5,484,134. In 1900 it was $4,764,124, the gain in 1901 being $720,010, or 15.11 per cent.

The fire-brick industry showed the smallest proportional gain, only 0.41 per cent, the actual gain being from $9,830,517 in 1900 to $9,870,421 in 1901, or only $39,904. This product finds its greatest use in the iron industry, either in the iron or steel furnaces direct or in the ovens for the manufacture of coke, which in turn is consumed in the iron and steel industries.

The only product to show a loss was in the stove-lining industry, which dropped from $462,541 in 1900 to $423,371 in 1901, a decrease of $39,170, or 8.47 per cent. As there are fewer than three producers of stove linings in Vermont, it has been necessary to put this product in the miscellaneous products of that State in order to prevent the disclosing of individual returns.

The production of drain tile depends largely upon the season; that is, in seasons of great rainfall the demand for this product is greater, and in seasons of drought the production is smaller. The drought of 1901 in the middle Western States is no doubt responsible for the small gain in that year over 1900. The sewer-pipe product increased in value $894,407, or 15.31 per cent. The increased use of terra cotta in architecture is indicated by the handsome gain made by this product over 1900—nearly $1,000,000, or 41.95 per cent.

The fireproofing industry showed only a slight gain over that reported for 1900—$40,055, or 2.20 per cent. This product is destined to form a very important portion of the clay products of the United States, owing to its increasing use in modern structures, and it is surprising to learn that its progress was not greater in the year under review.

The increase in the value of the clay products in 1900 over 1899 was due entirely to the increase in the value of the pottery products, the brick and tile products showing a decline of $2,133,345, and the pottery increasing $2,548,320, making the net gain $414,975. In 1901 both branches increased, the products embraced in our brick and tile class increasing $11,333,952, or 14.83 per cent, while the pottery gained $2,665,290 over 1900, or 13.46 per cent, the total net gain being $13,999,242, or 14.55 per cent.

The following table gives the output of products of clay in the United States from 1894 to 1901 by varieties of products, together with the total for each year and the number of operating firms reporting:

Products of clay in the United States from 1894 to 1901, inclusive, by varieties.

Year.	Number of operating firms reporting.	Common brick.			Front brick.		
		Quantity.	Value.	Average price per thousand.	Quantity.	Value.	Average price per thousand.
		Thousands.			*Thousands.*		
1894........	....	6,152,420	$35,062,538	$5.70	(*a*)	(*a*)	....
1895........	....	6,017,965	31,569,126	5.25	339,204	$4,399,367	$12.97
1896........	5,293	5,703,279	29,664,043	5.20	270,335	3,390,941	12.54
1897........	5,424	5,292,532	26,430,207	4.99	310,918	3,855,033	12.40
1898........	5,971	5,867,415	30,980,704	5.28	295,833	3,572,385	12.08
1899........	6,962	7,695,305	39,887,522	5.18	438,817	4,767,343	10.86
1900........	6,475	7,140,622	38,621,514	5.41	344,516	3,864,670	11.09
1901........	6,421	8,038,579	45,503,076	5.66	415,343	4,709,737	11.34

Year.	Vitrified paving brick.			Fancy or ornamental brick (value).	Enameled brick (value).	Fire brick (value).	Stove linings (value).	Drain tile (value).
	Quantity.	Value.	Average price per thousand.					
	Thousands.							
1894........	457,021	$3,711,073	$8.12	$1,128,608	(*b*)	$4,762,820	(*c*)	$5,803,168
1895........	381,591	3,130,472	8.20	652,519	(*b*)	5,279,004	(*c*)	3,450,961
1896........	320,407	2,794,585	8.72	763,140	(*b*)	4,944,723	(*c*)	2,613,513
1897........	435,851	3,582,037	8.22	685,048	(*b*)	4,094,704	(*c*)	2,623,305
1898........	474,419	4,016,822	8.47	358,372	$279,993	6,093,071	(*c*)	3,115,318
1899........	580,751	4,750,424	8.18	476,191	329,969	8,641,882	$416,235	3,682,394
1900........	546,679	4,764,124	8.71	289,698	323,630	9,830,517	462,541	2,976,281
1901........	605,077	5,484,134	9.06	372,131	463,709	9,870,421	423,371	3,143,001

Year.	Sewer pipe (value).	Ornamental terra cotta (value).	Fireproofing (value).	Tile, not drain (value).	Pottery (value.)	Miscellaneous.[d]	Total value.
1894........	$5,989,923	$1,476,185	$514,637	$1,688,724	(*e*)	$4,517,709	$64,655,385
1895........	4,482,577	2,512,193	741,626	2,572,628	(*e*)	6,619,333	65,409,806
1896........	4,588,503	2,359,983	1,706,504	1,618,127	$7,455,627	1,210,719	63,110,408
1897........	4,069,534	1,841,422	1,979,259	1,476,638	10,309,209	1,413,595	62,359,991
1898........	3,791,057	2,043,325	1,900,642	1,746,024	13,994,428	2,000,743	73,892,884
1899........	4,560,334	2,027,532	1,665,066	1,276,300	17,250,250	6,065,928	95,797,370
1900........	5,842,562	2,372,568	1,820,214	2,349,420	19,798,570	2,896,036	96,212,345
1901........	6,736,969	3,367,982	1,860,269	2,867,659	22,463,860	2,945,268	110,211,587

[a] Common and pressed brick not separately classified in 1894.

[b] Enameled brick not separately classified prior to 1898.

[c] Stove linings not separately classified prior to 1899.

[d] Including miscellaneous pottery products in 1894 and 1895.

[e] Pottery not separately classified in 1894 and 1895.

RANK OF STATES.

The following tables show the rank of States, the total value of products of clay, the percentage of the total products made by each State, and the number of operating firms reporting in each State in 1900 and 1901:

Rank of States and output of the products of clay in 1900 and 1901.

1901.

Rank.	State.	Number of operating firms reporting.	Value.	Per cent of total product.
1	Ohio	813	$21,574,985	19.58
2	Pennsylvania	507	15,321,742	13.90
3	New Jersey	160	11,681,878	10.60
4	Illinois	550	9,642,490	8.75
5	New York	276	8,291,718	7.52
6	Missouri	259	4,474,553	4.06
7	Indiana	540	4,466,454	4.05
8	Iowa	341	2,737,825	2.48
9	West Virginia	53	1,946,480	1.77
10	Massachusetts	90	1,870,837	1.70
11	California	92	1,769,155	1.61
12	Texas	201	1,723,375	1.56
13	Maryland	66	1,605,655	1.46
14	Colorado	91	1,594,867	1.45
15	Minnesota	116	1,548,647	1.41
16	Georgia	107	1,545,083	1.40
17	Michigan	180	1,542,034	1.40
18	Kentucky	117	1,514,543	1.37
19	Virginia	109	1,439,347	1.31
20	Wisconsin	170	1,247,544	1.13
21	Connecticut and Rhode Island	45	1,130,909	1.03
22	Kansas	58	981,020	.89
23	Alabama	118	946,791	.86
24	Washington	53	944,798	.86
25	Tennessee	119	893,967	.81
26	Nebraska	107	806,473	.73
27	North Carolina	293	771,338	.70
28	New Hampshire	37	765,964	.69
29	Maine	74	734,678	.67
30	Louisiana	61	615,703	.56
31	South Carolina	92	575,218	.52
32	Montana	32	539,221	.49
33	Mississippi	75	456,473	.41
34	Arkansas	75	407,263	.37
35	District of Columbia	15	324,008	.29
36	Utah	50	291,189	.26
37	Oregon and Hawaii	63	263,891	.24
38	Oklahoma	38	205,060	.19
39	Florida	24	190,674	.17
40	Delaware	23	131,164	.12
41	Indian Territory	18	117,224	.11
42	Arizona	23	92,986	.08
43	New Mexico	12	81,345	.07
44	Vermont	11	77,554	.07
45	North Dakota	9	76,708	.07
46	Idaho	32	68,328	.06
47	South Dakota	12	59,365	.05
48	Wyoming	9	28,950	.03
49	Nevada	5	17,625	.02
	Other States	....	[a]76,488	.07
	Total	6,421	110,211,587	100.00

[a] Comprising pottery totals for the following States: Florida, Kansas, Maine, Montana, New Hampshire, Oregon, and Utah. This total could not be distributed among the States to which it belongs without disclosing the operations of individual establishments.

Rank of States and output of the products of clay in 1900 and 1901—Continued.

1900.

Rank.	State.	Number of operating firms reporting.	Value.	Per cent of total product.
1	Ohio	871	$18,304,628	19.03
2	Pennsylvania	508	13,391,748	13.92
3	New Jersey	149	10,928,423	11.36
4	Illinois	569	7,708,859	8.01
5	New York	269	7,660,606	7.96
6	Indiana	567	3,858,350	4.01
7	Missouri	267	3,736,567	3.88
8	Iowa	358	2,291,251	2.38
9	West Virginia	53	2,016,765	2.10
10	Massachusetts	101	1,833,101	1.91
11	Maryland	55	1,711,856	1.78
12	Kentucky	118	1,481,324	1.54
13	Minnesota	114	1,396,697	1.45
14	California	72	1,375,998	1.43
15	Virginia	112	1,305,195	1.36
16	Colorado	72	1,200,519	1.25
17	Georgia	99	1,193,218	1.24
18	Michigan	189	1,181,695	1.23
19	Texas	193	1,171,017	1.22
20	Connecticut and Rhode Island	47	1,099,972	1.14
21	Wisconsin	168	1,072,179	1.11
22	Kansas	62	1,016,750	1.06
23	Tennessee	123	915,578	.95
24	North Carolina	256	815,975	.85
25	Maine	71	724,934	.75
26	Alabama	109	712,727	.74
27	South Carolina	102	711,336	.73
28	Nebraska	105	683,958	.71
29	Washington	48	625,459	.65
30	Mississippi	87	573,368	.60
31	Louisiana	59	507,694	.53
32	New Hampshire	50	485,013	.50
33	Arkansas	81	381,012	.40
34	Montana	26	350,489	.36
35	District of Columbia	14	288,933	.30
36	Oregon	64	281,385	.29
37	Utah	61	234,221	.24
38	Oklahoma	33	164,457	.17
39	Delaware	25	156,274	.16
40	Florida	21	140,604	.15
41	Vermont	15	121,041	.13
42	Arizona	24	112,737	.12
43	North Dakota	13	92,399	.10
44	Idaho	25	49,382	.05
45	South Dakota	13	43,440	.05
46	New Mexico	13	41,898	.04
47	Indian Territory	11	30,233	.03
48	Wyoming	8	21,500	.02
49	Nevada	5	9,580	.01
	Total	6,475	96,212,345	100.00

The following table shows the rank of the several States and Territories in the value of products of clay from 1894 to 1901:

Rank of clay-producing States, in value of products of clay, from 1894 to 1901, inclusive.

State.	1894.	1895.	1896.	1897.	1898.	1899.	1900.	1901.
Alabama	31	28	26	24	26	23	26	23
Arizona	46	47	43	41	40	44	42	42
Arkansas	34	33	34	35	34	34	33	34
California	16	10	21	21	12	12	14	11
Colorado	27	22	29	25	25	21	16	14
Connecticut[a]	20	20	11	10	16	20	20	21
Delaware	43	41	41	39	39	38	39	40
District of Columbia	28	27	28	30	30	33	35	35
Florida	40	39	39	38	38	41	40	39
Georgia	18	15	15	14	18	15	17	16
Idaho	44	44	46	46	47	45	44	46
Illinois	2	3	4	5	4	5	4	4
Indiana	6	6	7	6	6	6	6	7
Indian Territory	(b)	(b)	(b)	47	45	47	47	41
Iowa	8	9	9	9	8	8	8	8
Kansas	33	32	32	32	27	25	22	22
Kentucky	19	19	18	17	15	14	12	18
Louisiana	24	25	25	26	24	31	31	30
Maine	17	21	13	18	21	27	25	29
Maryland	11	13	10	11	10	11	11	13
Massachusetts	9	8	8	8	9	9	10	10
Michigan	10	11	12	19	14	15	18	17
Minnesota	15	12	20	15	11	18	13	15
Mississippi	38	36	33	31	31	32	30	33
Missouri	7	7	6	7	7	7	7	6
Montana	37	35	31	33	32	36	34	32
Nebraska	23	34	36	28	23	24	28	26
Nevada	....	....	....	....	....	48	49	49
New Hampshire	26	23	22	23	28	30	32	28
New Jersey	5	5	5	3	3	3	3	3
New Mexico	(b)	(b)	(b)	43	44	43	46	43
New York	4	4	3	4	5	4	5	5
North Carolina	30	26	24	27	29	26	24	27
North Dakota	42	42	42	40	42	39	43	45
Ohio	1	1	1	1	1	1	1	1
Oklahoma	[b] 41	[b] 43	[b] 45	44	41	41	38	38
Oregon[d]	36	37	38	37	37	35	36	37
Pennsylvania	3	2	2	2	2	2	2	2
Rhode Island	29	29	30	(c)	(c)	(c)	(c)	(c)
South Carolina	32	30	27	29	35	28	27	31
South Dakota	45	45	44	45	46	46	45	47
Tennessee	22	24	23	22	22	22	23	25
Texas	13	14	14	12	19	17	19	12
Utah	35	40	37	36	36	37	37	36
Vermont	39	38	40	42	43	42	41	44
Virginia	14	18	17	16	17	19	15	19
Washington	25	31	35	34	33	29	29	24
West Virginia	21	17	16	13	13	13	9	9
Wisconsin	12	16	19	20	20	10	21	20
Wyoming	47	46	47	48	48	49	48	48

[a] Including Rhode Island in 1897, 1898, 1899, 1900, and 1901.

[b] In 1894, 1895, and 1896 Indian Territory and New Mexico were included with Oklahoma Territory.

[c] Included with Connecticut in 1897, 1898, 1899, 1900, and 1901.

[d] Including Hawaii in 1901.

The widespread character of the industry is well known and is shown by the fact that every State and Territory, except Alaska, is represented in these figures. Hawaii appears for the first time, but since there are fewer than three producers, its product has been combined with that of Oregon.

Ohio is still the leading State in point of variety and value of clay goods made, producing $21,574,985 in 1901, or 19.58 per cent of the total product of the country, as compared with $18,304,628 worth of clay wares in 1900, or 19.03 per cent of the total.

There has been no great change in the rank of the States, the first five having maintained their relative positions for some time. Missouri and Indiana have exchanged places, the former taking sixth rank and the latter seventh.

The first three States produced over 40 per cent (44.08) of the total; the first five States produced 60.35 per cent, and the first ten over 74 per cent of the total.

The total number of producers reporting has decreased from 6,475 in 1900 to 6,421 in 1901. This is not because fewer plants are represented in these figures, but because of the consolidations in some States which report and are tabulated as one firm, but which in reality represent in some cases as many as twenty plants.

BRICK AND TILE.

PRODUCTION.

The following tables give the production and value of building brick and other structural products of clay, together with fire brick, paving brick, sewer pipe, drain, wall, floor, and other tile, in 1900 and 1901, the former year being presented for comparative purposes:

Brick and tile products of the United States in 1901.

State.	Common brick.		Average price per thousand.	Front brick.		Average price per thousand.
	Quantity.	Value.		Quantity.	Value.	
	Thousands.			*Thousands.*		
Alabama	128,914	$742,691	$5.76	795	$6,990	$8.79
Arizona	13,533	92,986	6.87	....	....	....
Arkansas	56,501	368,359	6.52	1,205	11,570	9.60
California	146,522	943,250	6.44	3,787	86,425	22.82
Colorado	116,160	760,867	6.55	16,563	196,147	11.84
Connecticut and Rhode Island	160,696	822,079	5.12	(a)	(a)	15.04
Delaware	15,963	126,092	7.90	(a)	(a)	16.00
District of Columbia	23,175	179,184	7.73	(a)	(a)	15.16
Florida	32,253	185,759	5.76	(a)	(a)	8.00
Georgia	222,111	1,182,553	5.32	5,325	55,700	10.46
Idaho	8,391	66,514	7.93	(a)	(a)	9.26
Illinois	930,561	5,188,654	5.58	19,241	204,980	10.65
Indiana	315,966	1,624,133	5.14	27,293	234,775	8.60
Indian Territory	17,603	110,774	6.29	(a)	(a)	10.00
Iowa	249,318	1,611,040	6.46	8,785	88,164	10.04
Kansas	108,365	555,928	5.13	5,495	50,340	9.13
Kentucky	115,977	621,756	5.36	2,486	16,535	6.65
Louisiana	94,981	560,375	5.27	(a)	(a)	10.00
Maine	69,819	407,354	5.83	2,530	22,350	8.83
Maryland	113,457	676,708	5.96	5,772	76,792	13.30
Massachusetts	170,455	1,060,493	6.22	6,950	98,892	14.23
Michigan	215,836	1,095,254	5.07	9,476	64,031	6.76
Minnesota	157,727	852,303	5.40	5,506	55,016	9.99
Mississippi	76,716	443,939	5.79	650	6,455	9.93
Missouri	276,821	1,595,031	5.76	26,301	298,158	11.34
Montana	51,739	357,210	6.90	1,248	18,432	14.77
Nebraska	109,060	668,863	6.13	6,806	85,260	12.53
Nevada	2,020	16,425	8.13	(a)	(a)	12.00
New Hampshire	114,532	741,589	7.35	(a)	(a)	8.25
New Jersey	351,886	1,675,746	4.76	29,239	473,138	16.18
New Mexico	9,885	72,045	7.29	(a)	(a)	9.50
New York	1,016,237	4,947,599	4.87	18,721	254,696	13.60
North Carolina	132,699	682,469	5.14	990	8,070	8.15
North Dakota	10,948	69,508	6.35	(a)	(a)	16.00
Ohio	489,275	2,725,512	5.57	69,405	612,718	8.83
Oklahoma	28,137	196,735	6.99	875	7,850	8.97
Oregon [b]	23,422	172,058	7.35	354	8,469	23.92
Pennsylvania	875,631	5,357,079	6.12	70,207	844,087	12.02
South Carolina	144,601	546,028	3.78	168	1,188	7.07
South Dakota	7,235	54 365	7.51	(a)	(a)	20.00
Tennessee	92,502	610,968	6.60	3,073	32,350	10.53
Texas	222,459	1,396,889	6.28	10,138	95,492	9.42
Utah	23,262	134,164	5.77	17,490	139,591	7.98
Vermont	11,872	61,554	5.18	....	....	....
Virginia	171,624	1,139,894	6.64	17,650	267,028	15.13
Washington	61,595	477,960	7.76	6,995	147,881	21.14
West Virginia	60,004	348,452	5.81	(a)	(a)	7.12
Wisconsin	187,173	1,151,838	6.15	6,527	54,379	8.33
Wyoming	2,960	24,050	8.12	(c)	(c)	14.00
Other States [d]	....	....	....	7,297	85,788	11.76
Total	8,038,579	45,503,076	5.66	415,343	4,709,737	11.34
Per cent of brick and tile products	....	51.86	....	....	5.37	....
Per cent of total of clay products	....	41.29	....	....	4.27	....

[a] Included in Other States.
[b] Includes Hawaii.
[c] Value of front brick for Wyoming included in Wyoming miscellaneous.
[d] Includes all products made by less than three producers in one State, in order that the operations of individual establishments may not be disclosed.

Brick and tile products of the United States in 1901—Continued.

State.	Vitrified brick.		Average price per thousand.	Fancy or ornamental brick (value).	Firebrick (value).	Stove linings (value).	Drain tile (value).
	Quantity.	Value.					
	Thousands.						
Alabama	(a)	(a)	$11.00		$132,783		(a)
Arizona							
Arkansas	(a)	(a)	10.00	$950	13,580		(a)
California	(a)	(a)	12.00	4,540	87,665	(a)	$50,156
Colorado	(a)	(a)	13.00	3,453	292,269	(a)	(a)
Connecticut and Rhode Island					(a)	(a)	
Delaware							(a)
District of Columbia				(a)			2,652
Florida							1,515
Georgia	(a)	(a)	7.69	12,200	35,000	(a)	(a)
Idaho							(a)
Illinois	99,572	$899,454	9.03	13,105	212,510		694,588
Indiana	31,468	320,221	10.18	8,160	51,526	(a)	772,241
Indian Territory					(a)		
Iowa	24,270	241,108	9.93	2,229	1,810		534,935
Kansas	41,574	312,994	7.53	(a)	(a)		3,300
Kentucky	(a)	(a)	12.71	(a)	377,741	(a)	29,498
Louisiana							
Maine	(a)	(a)	20.02		(a)		3,830
Maryland	(a)	(a)	15.00	11,000	342,055	$40,237	2,402
Massachusetts				63,040	57,945	135,570	
Michigan	(a)	(a)	12.30	(a)		(a)	98,972
Minnesota				(a)	(a)		6,739
Mississippi							(a)
Missouri	25,860	225,247	8.71	62,108	620,116	9,520	45,114
Montana				1,900	152,650		
Nebraska	3,850	28,150	7.31	(a)			(a)
Nevada							
New Hampshire					(a)		
New Jersey	2,251	22,024	9.78	11,514	780,327	(a)	22,612
New Mexico	(a)	(a)	7.00	(a)			
New York	29,950	343,343	11.46	(a)	293,944	115,054	73,554
North Carolina	(b)	(a)	10.00	(a)	3,720	(a)	5,042
North Dakota					(a)		
Ohio	175,757	1,443,537	8.21	49,021	1,287,059	(a)	707,409
Oklahoma					(a)		(a)
Oregon [b]				(a)	962		11,991
Pennsylvania	73,498	670,081	9.12	74,726	4,791,083	86,190	7,409
South Carolina					14,925	(a)	(a)
South Dakota					(a)		
Tennessee	6,624	67,129	10.13	(a)	37,100		15,961
Texas	(a)	(a)	8.70	1,339	23,337		904
Utah					5,100		(a)
Vermont						(c)	
Virginia				20,429	3,971		3,978
Washington	7,774	139,162	17.90	(a)	24,542		3,343
West Virginia	62,805	555,389	8.84	(a)	102,300		1,485
Wisconsin	(a)	(a)	7.50	2,105	(a)		22,727
Wyoming							
Other States [d]	19,824	216,295	10.91	30,312	124,401	36,800	20,644
Total	605,077	5,484,134	9.06	[e]835,840	9,870,421	423,371	3,143,001
Per cent of brick and tile products		6.25		.95	11.25	.48	3.58
Per cent of total products of clay		4.98		.76	8.96	.38	2.85

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[a] Included in Other States.

[b] Includes Hawaii.

[c] Stove linings for Vermont included in Vermont miscellaneous.

[d] Includes all products made by less than three producers in one State, in order that the operations of individual establishments may not be disclosed.

[e] Including enameled brick valued at $463,709, made in the following States: California, Illinois, Maryland, Missouri, New Jersey, Ohio, Pennsylvania, Tennessee, and Wisconsin. New Jersey and Ohio, with products, respectively, of $177,128 and $11,887, were the only States in which there were three or more producers of enameled brick.

Brick and tile products of the United States in 1901—Continued.

State	Sewer pipe (value	Ornamental terra cotta (value).	Fireproofing (value).	Tile, not drain (value).	Miscellaneous (value).[a]	Total value.
Alabama	....	....	....	....	$1,800	$928,429
Arizona	....	....	....	....	....	92,986
Arkansas	....	....	....	....	....	395,858
California	$285,599	$141,380	$12,825	(*b*)	70,781	1,735,721
Colorado	(*b*)	(*b*)	(*b*)	(*b*)	167,512	1,568,167
Connecticut and Rhode Island	....	....	(*b*)	....	109,500	1,039,709
Delaware	....	....	....	....	....	131,164
District of Columbia	95,000	....	....	....	32,000	311,129
Florida	(*b*)	....	....	....	2,500	190,674
Georgia	151,500	71,800	(*b*)	(*b*)	1,460	1,527,853
Idaho	....	....	....	....	272	68,328
Illinois	348,716	812,015	263,276	$229,746	28,121	8,960,041
Indiana	253,626	(*b*)	91,081	478,130	50,790	3,935,083
Indian Territory	....	....	....	....	....	117,224
Iowa	54,500	....	59,270	11,903	106,346	2,711,305
Kansas	(*b*)	....	(*b*)	....	40,000	981,020
Kentucky	100,705	....	(*b*)	(*b*)	....	1,374,846
Louisiana	....	....	....	....	27,220	612,595
Maine	(*b*)	....	....	....	....	734,678
Maryland	(*b*)	(*b*)	....	16,586	12,586	1,272,175
Massachusetts	....	(*b*)	(*b*)	(*b*)	13,301	1,589,469
Michigan	(*b*)	....	1,880	....	637	1,497,169
Minnesota	(*b*)	....	35,700	(*b*)	650	1,256,552
Mississippi	....	....	....	(*b*)	....	451,694
Missouri	788,513	223,554	59,043	60,202	359,160	4,409,906
Montana	(*b*)	....	(*b*)	(*b*)	639	539,221
Nebraska	....	....	....	....	11,700	806,473
Nevada	....	....	....	....	....	17,625
New Hampshire	....	....	....	....	....	765,964
New Jersey	(*b*)	920,664	610,864	486,122	458,316	5,781,805
New Mexico	....	....	....	....	....	81,345
New York	96,770	754,911	98,947	140,890	94,532	7,214,358
North Carolina	(*b*)	....	(*b*)	....	5,000	751,301
North Dakota	....	....	....	....	....	76,708
Ohio	2,735,703	(*b*)	357,284	996,005	599,682	11,526,424
Oklahoma	....	....	....	....	....	205,060
Oregon [c]	(*b*)	....	(*b*)	(*b*)	188	263,891
Pennsylvania	438,998	314,900	101,652	188,525	716,913	13,656,730
South Carolina	....	....	....	....	250	563,346
South Dakota	....	....	....	....	....	59,365
Tennessee	(*b*)	....	(*b*)	(*b*)	....	829,874
Texas	(*b*)	....	....	2,950	6,778	1,632,189
Utah	(*b*)	....	....	....	1,834	291,189
Vermont	....	....	....	....	[d] 16,000	77,554
Virginia	....	....	....	....	....	1,435,300
Washington	118,584	(*b*)	(*b*)	....	....	927,298
West Virginia	(*b*)	....	....	(*b*)	2,500	1,087,838
Wisconsin	....	....	(*b*)	(*b*)	1,400	1,234,144
Wyoming	....	....	....	....	[e] 4,900	28,950
Other States [f]	1,268,755	128,758	168,447	256,600	....	(*g*)
Total	6,736,969	3,367,982	1,860.269	2,867,659	2,945,268	$87,747,727
Per cent of brick and tile products	7.68	3.84	2.12	3.27	3.35	100.00
Per cent of total products of clay	6.11	3.06	1.69	2.60	2.67	79.62

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[a] Including adobes, assayers' supplies, boiler and locomotive tile and tank blocks, building blocks, burnt clay ballast, chemical brick, patent chimney brick, chimney pipe and tops, clay furnaces and retorts, conduit for underground wires, crucibles, cupola brick, fence posts and stubs, fire clay mortar, flue linings, frost-proof cellar brick, furnace mantels, gas logs and settings, glass-melting pots and glass-house furnace blocks, grave markers, hollow bricks, muffles, supports, and slides, porous cups, runner brick, sidewalk tile, souvenirs, stone pumps, terra-cotta vases, vitrified sewer brick, wall coping, water pipe, and well brick and tile.

[b] Included in Other States.

[c] Includes Hawaii.

[d] Includes stove linings for Vermont.

[e] Includes value of front brick for Wyoming.

[f] Includes all products made by less than three producers in one State, in order that the operations of individual establishments may not be disclosed.

[g] The total of Other States is distributed among the States to which it belongs, in order that they may be fully represented in the totals.

Brick and tile products of the United States in 1900.

State.	Common brick.		Average price per thousand.	Front brick.		Average price per thousand.
	Quantity.	Value.		Quantity.	Value.	
	Thousands.			*Thousands.*		
Alabama	89,693	$500,313	$5.58	1,040	$9,560	$9.19
Arizona	15,834	108,822	6.88	(a)	(a)	14.44
Arkansas	44,360	274,390	6.19	8,254	67,170	8.14
California	119,906	698,583	5.83	1,751	32,584	18.61
Colorado	79,286	471,235	5.94	13,390	143,470	10.71
Connecticut and Rhode Island	164,431	862,334	5.24	(a)	(a)	15.02
Delaware	19,316	144,860	7.50	708	7,414	10.47
District of Columbia	22,136	168,127	7.60	(a)	(a)	14.83
Florida	26,270	136,779	5.21	(a)	(a)	11.89
Georgia	195,463	982,083	5.02	5,591	49,800	8.91
Idaho	6,970	46,992	6.74	(a)	(a)	8.00
Illinois	685,161	3,981,577	5.84	26,040	240,989	9.25
Indiana	274,383	1,391,873	5.08	19,084	172,752	9.05
Indian Territory	4,550	30,233	6.64	....	....	....
Iowa	222,744	1,386,641	6.23	8,013	79,682	9.94
Kansas	92,364	482,952	5.23	6,122	57,764	9.44
Kentucky	113,863	608,334	5.34	2,282	21,098	9.25
Louisiana	88,319	463,613	5.25	2,320	19,100	8.23
Maine	63,170	353,731	5.60	3,330	27,050	8.12
Maryland	117,830	724,013	6.14	4,439	60,729	13.68
Massachusetts	198,693	1,123,586	5.65	4,884	87,575	17.93
Michigan	180,892	863,250	4.77	8,421	48,411	5.75
Minnesota	152,497	811,457	5.32	4,520	46,830	10.36
Mississippi	107,185	552,061	5.16	692	5,750	8.31
Missouri	195,930	1,057,497	5.40	22,013	228,070	10.36
Montana	32,977	219,465	6.65	536	8,217	15.33
Nebraska	88,917	553,905	6.23	6,599	95,528	14.48
Nevada	1,135	9,580	8.44	....	....	....
New Hampshire	80,582	423,713	5.26	3,659	33,175	9.07
New Jersey	331,579	1,449,694	4.37	25,229	426,692	16.91
New Mexico	5,141	38,268	7.44	....	....	....
New York	1,009,041	4,266,715	4.23	19,204	249,078	12.97
North Carolina	148,177	737,577	4.98	441	4,025	9.13
North Dakota	13,742	87,399	6.36	(a)	(a)	14.71
Ohio	411,532	2,232,090	5.42	40,923	433,086	10.58
Oklahoma	20,980	132,782	6.33	565	5,900	10.44
Oregon	24,686	168,369	6.82	195	2,690	13.79
Pennsylvania	744,663	4,484,590	6.02	54,068	596,559	11.03
South Carolina	140,618	665,998	4.73	1,482	10,784	7.28
South Dakota	5,192	41,324	7.96	(a)	(a)	17.71
Tennessee	108,759	609,994	5.61	7,645	59,493	7.78
Texas	170,124	964,743	5.67	3,827	35,605	9.30
Utah	29,766	174,579	5.86	3,734	31,039	8.31
Vermont	19,614	102,699	5.24	(a)	(a)	15.00
Virginia	153,409	934,185	6.09	15,617	275,847	17.66
Washington	55,671	404,687	7.27	1,480	31,840	21.51
West Virginia	103,760	708,861	6.83	1,610	16,797	10.43
Wisconsin	156,586	963,461	6.15	10,832	84,601	7.81
Wyoming	2,725	21,500	7.89	....	....	....
Other States [b]	....	....	....	3,976	57,916	14.57
Total	7,140,622	38,621,514	5.41	344,516	3,864,670	11.22
Per cent of brick and tile products	....	50.54	....	....	5.06	....
Per cent of total products of clay	....	40.14	....	....	4.02	....

[a] Included in Other States.

[b] Including all products made by less than three producers in one State, in order that the operations of individual establishments may not be disclosed.

Brick and tile products of the United States in 1900—Continued.

State.	Vitrified brick.		Average price per thousand.	Fancy or ornamental brick (value).	Fire brick (value).	Stove linings (value).	Drain tile (value).
	Quantity.	Value.					
	Thousands.						
Alabama	3,275	$30,250	$9.24	(a)	$148,665	....	(a)
Arizona	....	....	....	....	....	....	....
Arkansas	602	5,616	9.33	....	5,150	....	$1,306
California	....	....	....	(a)	48,461	$2,100	8,141
Colorado	2,213	22,130	10.00	(a)	207,475	....	5,600
Connecticut and Rhode Island	(a)	(a)	12.00	(a)	(a)	....	(a)
Delaware	....	....	....	....	....	....	(a)
District of Columbia	(a)	(a)	6.00	(a)	....	....	(a)
Florida	....	....	....	....	(a)	....	(a)
Georgia	(a)	(a)	10.00	(a)	35,502	(a)	(a)
Idaho	....	....	....	....	....	....	(a)
Illinois	87,724	720,089	8.21	$15,705	175,259	....	734,249
Indiana	30,326	331,276	10.92	7,310	40,976	(a)	674,602
Indian Territory	....	....	....	....	....	....	....
Iowa	17,338	151,386	8.73	1,750	2,145	(a)	377,586
Kansas	53,690	417,924	7.78	(a)	(a)	....	6,950
Kentucky	(a)	(a)	12.00	(a)	393,220	(a)	26,727
Louisiana	....	....	....	....	....	(a)	2,659
Maine	(a)	(a)	16.75	(a)	(a)	....	5,564
Maryland	74	595	8.04	9,886	321,666	36,049	2,363
Massachusetts	....	....	....	(a)	69,400	144,044	....
Michigan	(a)	(a)	12.42	(a)	(a)	....	114,747
Minnesota	(a)	(a)	6.00	(a)	(a)	....	2,745
Mississippi	....	....	....	....	(a)	....	455
Missouri	28,019	252,783	9.02	42,096	510,166	(a)	57,900
Montana	....	....	....	1,100	117,566	....	....
Nebraska	3,580	28,055	7.83	(a)	(a)	....	....
Nevada	....	....	....	....	....	....	....
New Hampshire	(a)	(a)	5.43	....	(a)	....	....
New Jersey	(a)	(a)	12.43	4,112	1,072,535	(a)	55,655
New Mexico	(a)	(a)	10.00	(a)	(a)	....	....
New York	29,943	347,671	11.61	(a)	360,933	93,188	89,019
North Carolina	(a)	(a)	8.00	(a)	714	(a)	7,186
North Dakota	....	....	....	....	(a)	....	....
Ohio	146,693	1,118,106	7.62	45,855	1,340,775	(a)	715,874
Oklahoma	(a)	(a)	11.20	(a)	....	....	(a)
Oregon	(a)	(a)	12.00	(a)	1,334	....	15,972
Pennsylvania	57,827	481,670	8.33	57,279	4,587,991	90,348	8,420
South Carolina	....	....	....	....	14,321	....	(a)
South Dakota	(a)	(a)	10.00	....	....	....	....
Tennessee	6,991	87,760	12.55	(a)	32,573	....	18,900
Texas	(a)	(a)	8.96	1,109	14,144	....	2,164
Utah	(a)	(a)	10.00	(a)	3,250	....	(a)
Vermont	....	....	....	....	....	....	(a)
Virginia	3,692	44,067	11.94	17,921	26,573	....	3,285
Washington	1,242	18,950	15.26	(a)	22,988	(a)	(a)
West Virginia	53,492	474,880	8.88	....	149,257	(a)	1,346
Wisconsin	....	....	....	2,272	(a)	....	14,995
Wyoming	....	....	....	....	....	....	....
Other States[b]	19,958	230,916	11.57	83,303	127,478	96,812	21,871
Total	546,679	4,764,124	8.71	[c] 613,328	9,830,517	462,541	2,976,281
Per cent of brick and tile products	....	6.23	....	.80	12.86	.61	3.90
Per cent of total products of clay	....	4.95	....	.64	10.22	.48	3.09

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[a] Included in Other States.

[b] Including all products made by less than three producers in one State, in order that the operations of individual establishments may not be disclosed.

[c] Including enameled brick valued at $323,630, made in the following States: California, Colorado, Illinois, Maryland, Missouri, New Jersey, North Carolina, Ohio, and Pennsylvania. New Jersey, with a product valued at $139,875, was the only State in which there were three or more producers of enameled brick.

Brick and tile products of the United States in 1900—Continued.

State.	Sewer pipe (value).	Ornamental terra cotta (value).	Firepoofing (value).	Title, not drain (value).	Miscellaneous (a) (value).	Total value.
Alabama					$2,825	$692,431
Arizona					15	112,737
Arkansas				$100	1,000	354,732
California	$357,867	$74,800	$15,500	(b)	100,675	1,351,611
Colorado	(b)		(b)	(b)	202,484	1,182,575
Connecticut and Rhode Island	(b)		(b)	(b)	13,988	1,038,722
Delaware						156,274
District of Columbia	69,374				35,929	278,060
Florida	(b)				250	140,604
Georgia	(b)	66,000	(b)			1,168,835
Idaho					190	49,382
Illinois	271,035	(b)	76,347	229,729	25,237	6,932,086
Indiana	279,719	(b)	116,581	343,985	112,576	3,532,450
Indian Territory						30,233
Iowa	52,462		25,900	5,450	171,485	2,254,662
Kansas					34,600	1,002,689
Kentucky	(b)	(b)	(b)	(b)		1,349,827
Louisiana		(b)			14,822	503,394
Maine	(b)			(b)		724,934
Maryland	(b)	(b)		(b)	26,193	1,275,239
Massachusetts		(b)	(b)	(b)	11,791	1,594,377
Michigan	57,916	(b)	2,350	(b)	406	1,147,378
Minnesota	(b)		(b)	(b)	4,160	1,103,302
Mississippi						558,916
Missouri	624,932	158,051	19,529	(b)	551,645	3,665,093
Montana	3,300		841			350,489
Nebraska				(b)		683,958
Nevada						9,580
New Hampshire			(b)			485,013
New Jersey	154,481	647,884	873,706	508,392	286,424	5,664,772
New Mexico						41,898
New York	94,293	676,408	93,994	105,519	107,136	6,495,281
North Carolina	(b)				5,000	797,112
North Dakota						92,399
Ohio	2,243,386	2,857	351,884	690,257	491,735	9,731,305
Oklahoma					20,000	164,457
Oregon	(b)		(b)		75	264,095
Pennsylvania	522,650	180,100	95,957	191,878	643,252	12,000,875
South Carolina					300	693,703
South Dakota						43,440
Tennessee	(b)		(b)	(b)		865,923
Texas	(b)			(b)	5,940	1,083,553
Utah	(b)	(b)	(b)		1,250	227,621
Vermont					18,000	121,041
Virginia	(b)				200	1,302,085
Washington	119,807	(b)	(b)		800	616,029
West Virginia	(b)			(b)	3,853	1,384,924
Wisconsin				(b)	1,800	1,072,179
Wyoming						21,500
Other States c	991,340	566,468	147,625	274,110		(d)
Total	5,842,562	2,372,568	1,820,214	2,349,420	2,896,036	76,413,775
Per cent of brick and tile products	7.65	3.11	2.38	3.07	3.79	100.00
Per cent of total products of clay	6.07	2.47	1.89	2.44	3.01	79.42

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[a] Including acid-proof brick, adobes, aquaria ornaments, burnt-clay ballast, chimney pipe and tops, condensers, conduits for underground wires, cupola blocks, curbing brick, crucibles, fire cement and mortar, fire kindlers, fire-clay retorts and special shapes, flue pipes and linings, foundation brick, frost-proof hollow cellar brick, furnace linings and settings, gas logs, glass melting pots and glass-house furnace blocks, grate tile, grave markers, hollow brick, lead pots, muffles, open-hearth runner brick, patent panels, perforated paving brick, porous cups, porous hollow brick, refractory fire-clay furnace linings, scorifiers, sewer brick, sidewalk tile and blocks, statuary, stone pumps, toy marbles, vases, web tile, well brick and tile.

[b] Included in other States.

[c] Including all products made by less than three producers in one State, in order that the operations of individual establishments may not be disclosed.

[d] The total of other States is distributed among the States to which it belongs, in order that they may be fully represented in the totals.

It will be seen from these tables that the products enumerated in 1901 composed 79.62 per cent of the total products of clay of the country, as compared with 79.42 per cent of the total in 1900. Of this total of the products of clay common brick was 41.29 per cent, or 51.86 per cent of the brick and tile products. In 1900 common brick was 40.14 per cent of the total clay products. The fire-brick product is the next largest, with 8.96 per cent of the total, as compared with 10.22 per cent of the total in 1900.

The quantity of brick increased from 7,140,622,000 in 1900 to 8,038,579,000 in 1901, while the average value per thousand increased from $5.41 in 1900 to $5.66 in 1901.

The vitrified brick product about held its own proportionately, though it increased from 546,679,000 in 1900 to 605,077,000 in 1901. The average value per thousand increased from $8.71 in 1900 to $9.06 in 1901.

RANK OF STATES.

The following tables show the rank of States in the output of brick and tile products, as distinguished from pottery products, and the percentage of the total made by each State and Territory, in 1900 and 1901, and will be of interest to those engaged exclusively in this line of industry:

Rank of States and output of brick and tile products in 1900 and 1901.

1901.

Rank.	State.	Value.	Per cent of total product.
1	Pennsylvania	$13,656,730	15.56
2	Ohio	11,526,424	13.14
3	Illinois	8,960,041	10.21
4	New York	7,214,358	8.22
5	New Jersey	5,781,805	6.59
6	Missouri	4,409,906	5.02
7	Indiana	3,935,083	4.48
8	Iowa	2,711,305	3.09
9	California	1,735,721	1.98
10	Texas	1,632,189	1.86
11	Massachusetts	1,589,469	1.81
12	Colorado	1,568,167	1.79
13	Georgia	1,527,853	1.74
14	Michigan	1,497,169	1.71
15	Virginia	1,435,300	1.64
16	Kentucky	1,374,846	1.57
17	Maryland	1,272,175	1.45
18	Minnesota	1,256,552	1.43
19	Wisconsin	1,234,144	1.41
20	West Virginia	1,087,838	1.24
21	Connecticut and Rhode Island	1,039,709	1.18
22	Kansas	981,020	1.12
23	Alabama	928,429	1.06
24	Washington	927,298	1.06
25	Tennessee	829,874	.95
26	Nebraska	806,473	.92
27	New Hampshire	765,964	.87
28	North Carolina	751,301	.86
29	Maine	734,678	.84
30	Louisiana	612,595	.70
31	South Carolina	563,346	.64
32	Montana	539,221	.61
33	Mississippi	451,694	.51
34	Arkansas	395,858	.45
35	District of Columbia	311,129	.35
36	Utah	291,189	.33
37	Oregon [a]	263,891	.30
38	Oklahoma	205,060	.23
39	Florida	190,674	.22
40	Delaware	131,164	.15
41	Indian Territory	117,224	.13
42	Arizona	92,986	.11
43	New Mexico	81,345	.09
44	Vermont	77,554	.09
45	North Dakota	76,708	.09
46	Idaho	68,328	.08
47	South Dakota	59,365	.07
48	Wyoming	28,950	.03
49	Nevada	17,625	.02
	Total	87,747,727	100.00

[a] Includes Hawaii.

Rank of States and output of brick and tile products in 1900 and 1901—Continued.

1900.

Rank.	State.	Value.	Per cent of total product.
1	Pennsylvania	$12,000,875	15.71
2	Ohio	9,731,305	12.74
3	Illinois	6,932,086	9.07
4	New York	6,495,281	8.50
5	New Jersey	5,664,772	7.41
6	Missouri	3,665,093	4.80
7	Indiana	3,532,450	4.62
8	Iowa	2,254,662	2.95
9	Massachusetts	1,594,377	2.09
10	West Virginia	1,384,924	1.81
11	California	1,351,611	1.77
12	Kentucky	1,349,827	1.77
13	Virginia	1,302,085	1.70
14	Maryland	1,275,239	1.67
15	Colorado	1,182,575	1.55
16	Georgia	1,168,835	1.53
17	Michigan	1,147,378	1.50
18	Minnesota	1,103,302	1.44
19	Texas	1,083,553	1.42
20	Wisconsin	1,072,179	1.40
21	Connecticut and Rhode Island	1,038,722	1.36
22	Kansas	1,002,689	1.31
23	Tennessee	865,923	1.13
24	North Carolina	797,112	1.04
25	Maine	724,934	.95
26	South Carolina	693,703	.91
27	Alabama	692,431	.91
28	Nebraska	683,958	.90
29	Washington	616,029	.81
30	Mississippi	558,916	.73
31	Louisiana	503,394	.66
32	New Hampshire	485,013	.63
33	Arkansas	354,732	.46
34	Montana	350,489	.46
35	District of Columbia	278,060	.36
36	Oregon	264,095	.35
37	Utah	227,621	.30
38	Oklahoma	164,457	.22
39	Delaware	156,274	.20
40	Florida	140,604	.18
41	Vermont	121,041	.16
42	Arizona	112,737	.15
43	North Dakota	92,399	.12
44	Idaho	49,382	.06
45	South Dakota	43,440	.06
46	New Mexico	41,898	.05
47	Indian Territory	30,233	.04
48	Wyoming	21,500	.03
49	Nevada	9,580	.01
	Total	76,413,775	100.00

It will be noted that while Ohio is the leading State in point of value of all the products of clay, in the brick and tile industry Pennsylvania is the leading State. This is due to the large quantities of building and fire brick made in this State, whereas Ohio's largest products are vitrified brick, drain tile, sewer pipe, fireproofing, and tile not drain.

PRICES.

The following tables show the average value per thousand of various kinds of brick in 1900 and 1901, by States:

Average value per thousand of various kinds of brick in 1901, by States

COMMON BRICK.

Hawaii	$15.50	Pennsylvania	$6.12
Nevada	8.13	Rhode Island	6.00
Wyoming	8.12	Maryland	5.96
Idaho	7.93	Maine	5.83
Delaware	7.90	West Virginia	5.81
Washington	7.76	Mississippi	5.79
District of Columbia	7.73	Utah	5.77
South Dakota	7.51	Alabama	5.76
New Hampshire	7.35	Florida	5.76
New Mexico	7.29	Missouri	5.76
Oklahoma	6.99	Illinois	5.58
Montana	6.90	Ohio	5.57
Arizona	6.87	Minnesota	5.40
Oregon	6.67	Kentucky	5.36
Virginia	6.64	Georgia	5.32
Tennessee	6.60	Louisiana	5.27
Colorado	6.55	Vermont	5.18
Arkansas	6.52	Indiana	5.14
Iowa	6.46	North Carolina	5.14
California	6.44	Kansas	5.13
North Dakota	6.35	Michigan	5.07
Indian Territory	6.29	Connecticut	4.99
Texas	6.28	New York	4.87
Massachusetts	6.22	New Jersey	4.76
Wisconsin	6.15	South Carolina	3.78
Nebraska	6.13		

FRONT BRICK.

Oregon	$23.92	New York	$13.60
Connecticut	23.00	Maryland	13.30
California	22.82	Nebraska	12.53
Washington	21.14	Pennsylvania	12.02
South Dakota	20.00	Nevada	12.00
New Jersey	16.18	Colorado	11.84
Delaware	16.00	Missouri	11.34
District of Columbia	15.16	Illinois	10.65
Virginia	15.13	Tennessee	10.53
Rhode Island	15.00	Georgia	10.46
Montana	14.77	Iowa	10.04
Massachusetts	14.23	Indian Territory	10.00
Wyoming	14.00	Louisiana	10.00

Average value per thousand of various kinds of brick in 1901, by States—Continued.

FRONT BRICK—continued.

Minnesota	$9.99	Indiana	$8.60
Mississippi	9.93	Wisconsin	8.33
Arkansas	9.60	New Hampshire	8.25
New Mexico	9.50	North Carolina	8.15
Texas	9.42	Florida	8.00
Idaho	9.26	Utah	7.98
Kansas	9.16	West Virginia	7.12
Oklahoma	8.97	South Carolina	7.07
Maine	8.83	Michigan	6.76
Ohio	8.83	Kentucky	6.65
Alabama	8.79		

VITRIFIED BRICK.

Maine	$20.02	Iowa	$9.93
Washington	17.90	New Jersey	9.78
Maryland	15.00	Pennsylvania	9.12
Colorado	13.00	Illinois	9.03
Kentucky	12.71	West Virginia	8.84
Michigan	12.30	Missouri	8.71
California	12.00	Texas	8.70
New York	11.46	Ohio	8.21
Alabama	11.00	Georgia	7.69
Indiana	10.18	Kansas	7.53
Tennessee	10.13	Wisconsin	7.50
Arkansas	10.00	Nebraska	7.31
North Carolina	10.00	New Mexico	7.00

Average value per thousand of various kinds of brick in 1900, by States.

COMMON BRICK.

Nevada	$8.44	Illinois	$5.84
South Dakota	7.96	California	5.83
Wyoming	7.89	Texas	5.67
District of Columbia	7.60	Massachusetts	5.65
Delaware	7.50	Tennessee	5.61
New Mexico	7.44	Maine	5.60
Washington	7.27	Alabama	5.58
Arizona	6.88	Ohio	5.42
West Virginia	6.83	Missouri	5.40
Oregon	6.82	Kentucky	5.34
Idaho	6.74	Minnesota	5.32
Montana	6.65	New Hampshire	5.26
Indian Territory	6.64	Louisiana	5.25
North Dakota	6.36	Vermont	5.24
Oklahoma	6.33	Kansas	5.23
Nebraska	6.23	Florida	5.21
Iowa	6.23	Mississippi	5.16
Arkansas	6.19	Connecticut	5.10
Wisconsin	6.15	Indiana	5.08
Maryland	6.14	Georgia	5.02
Virginia	6.09	North Carolina	4.98
Pennsylvania	6.02	Michigan	4.77
Rhode Island	6.00	South Carolina	4.73
Colorado	5.94	New Jersey	4.37
Utah	5.86	New York	4.23

Average value per thousand of various kinds of brick in 1900, by States—Continued.

FRONT BRICK.

Washington	$21.51	West Virginia	$10.43
Connecticut	20.00	Minnesota	10.36
California	18.61	Missouri	10.36
Massachusetts	17.93	Iowa	9.94
South Dakota	17.71	Kansas	9.44
Virginia	17.66	Texas	9.30
New Jersey	16.91	Illinois	9.25
Montana	15.33	Kentucky	9.25
Rhode Island	15.00	Alabama	9.19
Vermont	15.00	North Carolina	9.13
District of Columbia	14.83	New Hampshire	9.07
North Dakota	14.71	Indiana	9.05
Nebraska	14.48	Georgia	8.91
Arizona	14.44	Utah	8.31
Oregon	13.79	Mississippi	8.31
Maryland	13.68	Louisiana	8.23
New York	12.97	Arkansas	8.14
Florida	11.89	Maine	8.12
Pennsylvania	11.03	Idaho	8.00
Colorado	10.71	Wisconsin	7.81
Ohio	10.58	Tennessee	7.78
Delaware	10.47	South Carolina	7.28
Oklahoma	10.44	Michigan	5.75

VITRIFIED BRICK.

Maine	$16.75	Arkansas	$9.33
Washington	15.26	Alabama	9.24
Tennessee	12.55	Missouri	9.02
New Jersey	12.43	Texas	8.96
Michigan	12.42	West Virginia	8.88
Kentucky	12.00	Iowa	8.73
Oregon	12.00	Pennsylvania	8.33
Rhode Island	12.00	Illinois	8.21
Virginia	11.94	Maryland	8.04
New York	11.61	North Carolina	8.00
Oklahoma	11.20	Nebraska	7.83
Indiana	10.92	Kansas	7.78
Colorado	10.00	Ohio	7.62
Georgia	10.00	District of Columbia	6.00
New Mexico	10.00	Minnesota	6.00
South Dakota	10.00	New Hampshire	5.43
Utah	10.00		

Hawaii leads in the average value per thousand for common brick, at $15.50; Nevada is second, with brick worth $8.13; and Wyoming a close third, at $8.12. The lowest-priced brick are reported from South Carolina, where the average value was $3.78 per thousand. In 1900 New York had the lowest average value—$4.23, and South Carolina's product in that year averaged $4.73 per thousand. New Jersey has been second from the last for two years, with her product averaging $4.76 and $4.37, respectively.

The following table gives statistics of the clay-working industries along the Hudson River from Albany and Rensselaer counties, N. Y., to New York City, including Bergen County, N. J. This comprises one of the most interesting regions, from a brickmaker's point of view, in the country. The product is almost entirely—90 per cent—common brick and is made on "summer yards"—that is, yards operated from April to October, though shipping is carried on during nearly the whole year, the product going almost entirely to New York City on barges.

The average price per thousand is shown to be $4.67, ranging from $4.27 in Bergen County, N. J., to $5.39 in Greene County, N. Y. These figures represent the value f. o. b. barges at the yard. This is, quality considered, probably the cheapest brick in the United States.

The process of manufacture is almost exclusively by soft-mud machines, and the drying is done very largely on the ground, though there are a number of yards which dry by the pallet system.

These figures include the product of the counties named, which in many instances is made exclusively along the river, though in some cases, especially in Albany County, plants located some distance from the river, whose produce is used locally, are included.

Clay products of the Hudson River district, from Cohoes to New York City.

County.	Number of firms reporting.	Common brick.		Average price per thousand.
		Quantity.	Value.	
		Thousands.		
Albany	9	43,624	$221,818	$5.08
Columbia	4	44,200	219,000	4.95
Dutchess	18	139,895	630,190	4.50
Greene	4	32,810	176,713	5.39
Orange	10	78,254	388,507	4.96
Rensselaer	8	10,018	45,564	4.55
Rockland	36	213,885	994,348	4.65
Ulster	20	161,688	697,010	4.31
Westchester	9	59,750	310,425	5.21
Total for New York	118	784,124	3,683,575	4.70
Bergen County, N. J	9	46,030	196,640	4.27
Total	127	830,154	3,880,215	4.67

In addition to the foregoing, 7 firms in this region reported fire brick, stove linings, drain tile, fireproofing, vitrified paving brick, and front brick to the value of $423,044, making a total of $4,106,619 for this portion of New York, and a total of $4,303,259 for the entire Hudson River region from Albany and Rensselaer counties to New York City.

POTTERY.

INTRODUCTION.

The year 1901 was another exceedingly prosperous one in the pottery industry, as shown by the figures which follow. What is more gratifying than the mere increase in the value of the ware marketed is the steady growth of the artistic tastes of the people, as evidenced by the success of Rookwood and Newcomb pottery, and the increased favor with which American ware of all classes is being received at the hands of the public. The greater part of the pottery now sold in America is of domestic manufacture, and this proportion is steadily increasing, though unfortunately not very rapidly, and it is to be regretted that the highest grade ware is still principally of foreign make.

With the exception of the earthenware and stoneware branches, pottery manufacture as developed in the United States—unlike the brick and tile industry, whose products will not as a rule stand much transportation—has not been established adjacent to deposits of the raw material, but is now rather dependent upon localities in which there is an available supply of the skilled labor necessary to carry on the industry. This explains the rapid development in localities where the industry is already established, such as Trenton, N. J., and East Liverpool, Ohio, the largest centers in the country. The influence of the latter place is becoming general in eastern Ohio, western Pennsylvania, and West Virginia, where a considerable number of new plants have recently been established. This condition will undoubtedly have its effect on these centers, and if the rapid growth of the industry in the vicinity of East Liverpool continues, it is probably safe to predict that the territory around that place—say within a radius of 50 miles—will become the greatest pottery center of the world.

The card of inquiry for 1901 called for a subdivision of the products into plain and decorated ware, similar to that in the report for 1900. Unfortunately, however, the number of producers reporting decorated ware in some of the grades in some States is fewer than three, hence it has been impossible to give several of the States full credit in the table by States for decorated ware. In the table giving the product by varieties the figures are the correct totals for the several varieties as reported to this office.

PRODUCTION.

The following tables give the value of the pottery products of the United States by varieties of products, by States, in 1900 and 1901:

Value of pottery products of the United States in 1901, by States.

PLAIN.

State.	Red earthenware.	Stoneware.	Yellow or rockingham ware.	C. C. ware.	White granite and semi-porcelain ware.	Semivitreous porcelain ware.
Alabama	$1,030	$17,252	....	(*b*)	....	....
Arkansas	(*d*)	10,898	....	....	....	....
California	20,672	6,587	....	....	....	....
Colorado	(*b*)	(*b*)	....	....	(*b*)	....
Connecticut	18,200	(*b*)	....	....	....	....
District of Columbia	12,879	....	....	....	....	....
Florida	(*b*)	(*b*)	....	....	....	....
Georgia	5,229	11,181	(*b*)	(*b*)	....	....
Illinois	6,600	585,649	(*b*)	....	....	(*b*)
Indiana	6,650	47,721	....	....	(*b*)	....
Iowa	18,300	(*e*)	....	....	....	....
Kansas	....	(*b*)	....	....	....	....
Kentucky	19,929	115,768	....	....	....	....
Louisiana	(*b*)	....	....	....	....	....
Maine	(*b*)	(*b*)	....	....	....	....
Maryland	13,374	....	(*b*)	(*c*)	(*b*)	....
Massachusetts	122,704	22,291	....	(*b*)	....	(*b*)
Michigan	42,465	....	....	....	....	....
Minnesota	10,000	279,295	....	....	....	....
Mississippi	854	3,520	....	....	....	....
Missouri	13,800	48,827	....	....	....	....
Montana	(*b*)	....	....	....	....	....
New Hampshire	....	....	....	....	....	(*b*)
New Jersey	21,489	60,000	(*f*)	$293,455	$718,613	$60,321
New York	27,472	48,596	....	(*b*)	....	....
North Carolina	2,015	17,470	....	(*b*)	....	....
Ohio	72,746	735,977	$131,843	424,066	1,580,900	1,306,221
Oregon	(*b*)	(*b*)	....	....	....	....
Pennsylvania	109,233	320.800	(*b*)	....	(*b*)	60,000
South Carolina	2,995	8,852	....	....	....	....
Tennessee	(*b*)	62,093	(*b*)	....	....	....
Texas	18,851	71,325	....	....	....	....
Utah	(*b*)	....	....	....	....	....
Virginia	(*b*)	(*b*)	....	....	....	....
Washington	(*h*)	14,762	....	....	....	....
West Virginia	....	13,069	....	(*b*)	130,073	(*b*)
Wisconsin	8,900	....	....	....	....	....
Other States *c*	13,294	61,064	80,669	267,687	323,903	122,700
Total plain	589,681	2,562,997	212,512	985,208	2,753,489	1,549,242

DECORATED.

California	(*b*)	....	....	....	....	....
Maryland	....	....	....	....	(*b*)	(*b*)
Massachusetts	(*n*)	....	....	....	....	....
New Jersey	....	(*b*)	....	$150,000	$767,650	(*b*)
New York	....	....	....	....	....	....
Ohio	$71,322	$72,284	(*k*)	302,255	1,129,826	$2,213,787
Pennsylvania	1,400	....	....	....	697,000	(*b*)
West Virginia	....	....	....	....	243,800	(*b*)
Other States *c*	41,295	7,845	....	....	89,000	727,641
Total decorated	114,017	80,129	(*k*)	452,255	2,927,276	2,941,428
Grand total	703,698	2,643,126	$212,512	1,437,463	5,680,765	4,490,670
Per cent of total clay products	.64	2.40	.19	1.30	5.15	4.07
Per cent of pottery products	3.13	11.77	.95	6.40	25.29	19.99

Value of pottery products of the United States in 1901, by States—Continued.

PLAIN.

State.	China.	Bone china, delft, and belleek ware.	Sanitary ware.	Porcelain electrical supplies.	Miscellaneous.[a]	Total.
Alabama						$18,312
Arkansas					$507	11,405
California					275	27,534
Colorado						26,700
Connecticut				(b)		43,700
District of Columbia						12,879
Florida			(b)			(i)
Georgia			(b)	(b)	300	17,230
Illinois					9,200	676,149
Indiana			(b)	(b)		467,371
Iowa					5,620	23,920
Kansas						(i)
Kentucky						135,697
Louisiana						1,830
Maine						(i)
Maryland					2,500	171,480
Massachusetts					4,615	210,610
Michigan					2,400	44,865
Minnesota						289,295
Mississippi					405	4,779
Missouri						62,627
Montana						(i)
New Hampshire						(i)
New Jersey	$344,224	$237,835	$2,194,354	$342,479	88,357	4,361,127
New York	242,868		(b)	310,214	33,932	815,656
North Carolina			(b)		500	20,012
Ohio	(b)		(b)	325,664	400,957	5,311,674
Oregon						(i)
Pennsylvania			(b)		38,676	816,612
South Carolina						11,847
Tennessee						64,093
Texas			(g)		310	90,486
Utah						(i)
Virginia					3,072	4,047
Washington					2,738	17,500
West Virginia			(b)			297,842
Wisconsin					1,000	9,900
Other States [c]	150,300		565,746	163,005		[j] 58,003
Total plain	737,392	237,835	2,760,100	1,141,362	595,364	14,125,182
DECORATED.						
California			(b)			$5,900
Maryland						162,000
Massachusetts					$70,758	70,758
New Jersey	$321,724	(l)	(b)		82,861	1,538,946
New York	(o)				261,704	261,704
Ohio	(b)				851,500	4,736,887
Pennsylvania						848,400
West Virginia			(b)			560,800
Other States [c]	95,913		$117,550		21,563	[m] 153,283
Total decorated	417,637	(l)	117,550		1,288,386	8,338,678
Grand total	1,155,029	$237,835	2,877,650	$1,141,362	1,883,750	22,463,860
Per cent of total clay products	1.05	.22	2.61	1.04	1.71	20.38
Per cent of pottery products	5.14	1.06	12.81	5.08	8.38	100.00

[a] Including art and chemical pottery, casters, cuspidors, enameled earthenware and terra cotta, faience ware, flemish ware, jardinieres and pedestals, lead pots, pins, stilts and spurs for potters' use; porcelain door, picture, and shutter knobs; porcelain filter tubes, shuttle eyes and thread guides, porcelain hardware trimmings, smoking pipes, toy marbles, umbrella stands, washboards, white earthenware, and white-lined earthenware.

[b] Included in Other States.

[c] Includes all products made by less than three producers in one State, in order that the operations of individual establishments may not be disclosed. The total of Other States (plain pottery) is distributed among the States to which it belongs, in order that they may be fully represented in the totals.

[d] Red earthenware for Arkansas included in Arkansas miscellaneous.

[e] Stoneware for Iowa included in Iowa miscellaneous.

[f] Yellow or rockingham ware for New Jersey included in New Jersey miscellaneous.

[g] Sanitary ware for Texas included in Texas miscellaneous.

[h] Red earthenware for Washington included in Washington miscellaneous.

[i] Included in *j* ($58,003).

[j] Made up of State totals of Florida, Kansas, Maine, Montana, New Hampshire, Oregon, and Utah.

[k] Decorated yellow or rockingham ware for Ohio included in Ohio miscellaneous.

[l] Decorated bone china, delft, and belleek ware for New Jersey included in New Jersey miscellaneous.

[m] Made up of State totals of Alabama, Connecticut, Florida, Illinois, Indiana, Iowa, Kentucky, Louisiana, Minnesota, Missouri, New Hampshire, North Carolina, Oregon, South Carolina, Texas, and Wisconsin, in order to prevent the disclosure of the operations of individual establishments.

[n] Decorated earthenware for Massachusetts included in Massachusetts miscellaneous.

[o] Decorated china for New York included in New York miscellaneous.

Value of pottery products of the United States in 1900, by States.

PLAIN.

State.	Red earthenware.	Stoneware.	Yellow or rockingham ware.	C. C. ware.	White granite and semi-porcelain ware.	Semivitreous porcelain ware.
Alabama	$1,365	$18,481	...	(*a*)	...	...
Arkansas	2,460	23,820	...	...	...	...
California	13,800	8,587	...	...	...	...
Colorado	(*a*)	(*a*)	...	...	...	...
Connecticut	17,250	(*a*)	...	...	...	...
District of Columbia	10,873	...	...	...	...	...
Florida	(*a*)	(*a*)	...	...	...	...
Georgia	6,098	13,945	(*a*)	(*a*)	...	...
Idaho	(*a*)	...	(*a*)	...	...	...
Illinois	57,068	578,405	...	(*a*)	(*a*)	...
Indiana	4,337	44,207	...	...	(*a*)	...
Iowa	5,500	25,739	...	...	...	...
Kansas	...	14,061	...	...	...	...
Kentucky	21,202	110,295	...	...	...	...
Louisiana	2,400	(*a*)	...	...	...	...
Maine	(*a*)	...	...	...	...	...
Maryland	8,080	...	(*a*)	(*a*)	...	...
Massachusetts	101,364	22,198	(*a*)	(*a*)	...	...
Michigan	34,317	...	...	...	...	...
Minnesota	(*a*)	(*a*)	...	...	...	...
Mississippi	161	13,955	...	...	...	...
Missouri	10,865	58,509	...	(*a*)	...	...
Montana	(*a*)	...	...	...	...	...
New Hampshire	...	...	...	...	...	(*b*)
New Jersey	28,600	46,650	(*a*)	$345,249	$494,282	*c* $96,447
New York	25,207	37,008	...	(*a*)	...	...
North Carolina	1,937	16,498	...	...	...	...
Ohio	75,720	646,445	$142,207	707,047	1,715,157	942,478
Oregon	2,383	(*a*)	...	...	...	...
Pennsylvania	86,582	255,457	(*a*)	(*a*)	465,000	...
South Carolina	5,688	11,945	...	...	...	...
Tennessee	(*a*)	48,325	...	...	...	...
Texas	3,242	84,222	...	...	...	...
Utah	6,600	...	...	...	...	...
Virginia	425	(*a*)	...	...	...	...
Washington	810	8,620	...	...	...	...
West Virginia	...	9,827	...	(*a*)	(*a*)	...
Wisconsin	13,000	...	...	...	...	...
Other States *e*	13,524	300,702	73,072	299,178	226,078	...
Total plain	560,858	2,397,901	215,279	1,351,474	2,900,517	1,038,925

DECORATED.

State.	Red earthenware.	Stoneware.	Yellow or rockingham ware.	C. C. ware.	White granite and semi-porcelain ware.	Semivitreous porcelain ware.
Maryland	(*a*)	...	...	(*a*)	(*a*)	(*a*)
Massachusetts	$53,340	...	...	...	...	...
New Jersey	...	...	...	$199,000	$645,338	$292,479
New York	...	...	...	...	...	...
Ohio	178,650	(*a*)	(*d*)	349,179	1,052,680	1,308,735
Pennsylvania	2,100	...	...	...	365,000	...
West Virginia	...	...	...	(*a*)	(*a*)	...
Other States *e*	37,499	$49,436	...	64,805	586,331	169,500
Total decorated	271,589	49,436	(*d*)	612,984	2,649,349	1,770,714
Grand total	832,447	2,447,337	$215,279	1,964,458	5,549,866	2,809,639
Per cent of total clay products	.87	2.54	.22	2.04	5.77	2.92
Per cent of pottery products	4.21	12.36	1.09	9.92	28.03	14.19

[a] Included in Other States.

[b] Included in New Jersey.

[c] Includes semivitreous porcelain ware for New Hampshire.

[d] Included in Ohio miscellaneous.

[e] Includes all products made by less than three producers in one State, in order that the operations of individual establishments may not be disclosed.

Value of pottery products of the United States in 1900, by States—Continued.

PLAIN.

State.	China.	Bone china, delft, and belleek ware.	Sanitary ware.	Porcelain electrical supplies.	Miscellaneous.[a]	Total.
Alabama						$20,046
Arkansas						26,280
California			(b)			24,387
Colorado						15,200
Connecticut					(b)	36,250
District of Columbia						10,873
Florida			(b)			(c)
Georgia					(b)	21,033
Idaho						(c)
Illinois					$4,800	708,273
Indiana			(b)	(d)		d 278,374
Iowa					(b)	36,489
Kansas						14,061
Kentucky						131,497
Louisiana						2,900
Maine						(c)
Maryland			(b)			141,082
Massachusetts					(b)	171,162
Michigan						34,317
Minnesota						(c)
Mississippi						14,116
Missouri			(b)			71,474
Montana						(c)
New Hampshire						(e)
New Jersey	$345,112	$38,800	$1,807,953	$285,466	325,389	f 3,820,948
New York	g 395,774		(b)	h 382,832	37,453	931,597
North Carolina						18,435
Ohio	(i)		(b)	247,135	549,994	i 5,131,183
Oregon						17,290
Pennsylvania					103,179	1,023,773
South Carolina						17,633
Tennessee						48,855
Texas						87,464
Utah						6,600
Virginia					(b)	2,910
Washington						9,430
West Virginia			(b)			222,949
Wisconsin					(b)	14,000
Other States j			373,544		30,385	k 281,889
Total plain	740,886	38,800	2,181,497	915,433	1,051,200	13,392,770

DECORATED.

State.	China.	Bone china, delft, and belleek ware.	Sanitary ware.	Porcelain electrical supplies.	Miscellaneous.[a]	Total.
Maryland						$295,535
Massachusetts					$14,072	67,412
New Jersey	(b)	(b)	(b)			1,431,703
New York	(b)				(b)	233,728
Ohio	(b)				412,060	3,442,140
Pennsylvania						367,100
West Virginia		(b)	(b)			408,892
Other States j	$481,471	$31,432	$35,555		77,138	l 159,290
Total decorated	481,471	31,432	35,555		503,270	6,405,800
Grand total	1,222,357	70,232	2,217,052	$915,433	1,554,470	19,798,570
Per cent of total clay products	1.27	.07	2.31	.95	1.62	20.58
Per cent of pottery products	6.17	.36	11.20	4.62	7.85	100.00

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[a] Including acid-proof tanks, art and chemical pottery, bath tubs, caster wheels, electrical supplies, faience, glass pots, insulators, jardinieres, lavatories, pins, stilts, and spurs for potters' use; porcelain door, picture, and shutter knobs; filter tubes, shuttle eyes, and thread guides; pump wheels, sinks, smoking pipes, statues, wash tubs and boards, and white earthenware.

[b] Included in Other States.

[c] Included in k ($281,889).

[d] Porcelain electrical supplies for Indiana included in New York.

[e] Included in New Jersey.

[f] Includes semivitreous porcelain ware for New Hampshire.

[g] Includes china for Ohio.

[h] Includes porcelain electrical supplies for Indiana.

[i] China for Ohio included in New York.

[j] Includes all products made by less than three producers in one State, in order that the operations of individual establishments may not be disclosed.

[k] Includes State totals for Florida, Idaho, Maine, Minnesota, and Montana, in order that the operations of individual establishments may not be disclosed.

[l] Includes State totals for Alabama, Connecticut, Florida, Illinois, Indiana, Iowa, Louisiana, Minnesota, Mississippi, New Hampshire, North Carolina, Tennessee, Virginia, and Wisconsin, in order that the operations of individual establishments may not be disclosed.

These tables show that the pottery industry has shared in the general prosperity of the times, the product increasing in value from $19,798,570 in 1900 to $22,463,860 in 1901, a gain of $2,665,290, or 13.46 per cent. The gain in 1900 over 1899 was $2,660,999, or 14.77 per cent. As heretofore, the white ware composes by far the largest part of the pottery products, though the commonest grades, such as red earthenware and stoneware are distributed more widely geographically.

It is regretted that the separation of the product into plain and decorated is not more satisfactory, but as there are fewer than three producers in one State in so many of the varieties of pottery, it has been necessary to combine the products reported to prevent the disclosing of individual returns.

The following tables give the value of the pottery products, by States, and of the plain and decorated ware made in each State, for 1900 and 1901:

Value of the pottery products of the United States in 1901.

State.	Plain.	Decorated.	Total.
Alabama	$18,312	$50	$18,362
Arkansas	11,405	....	11,405
California	27,534	5,900	33,434
Colorado	26,700	....	26,700
Connecticut	43,700	47,500	91,200
District of Columbia	12,879	....	12,879
Florida	(*a*)	(*a*)	(*a*)
Georgia	17,230	....	17,230
Illinois	676,149	6,300	682,449
Indiana	467,371	64,000	531,371
Iowa	23,920	2,600	26,520
Kansas	(*a*)	....	(*a*)
Kentucky	135,697	4,000	139,697
Louisiana	1,830	1,278	3,108
Maine	(*a*)	....	(*a*)
Maryland	171,480	162,000	333,480
Massachusetts	210,610	70,758	281,368
Michigan	44,865	....	44,865
Minnesota	289,295	2,800	292,095
Mississippi	4,779	....	4,779
Missouri	62,627	2,020	64,647
Montana	(*a*)	....	(*a*)
New Hampshire	(*a*)	(*a*)	(*a*)
New Jersey	4,361,127	1,538,946	5,900,073
New York	815,656	261,704	1,077,360
North Carolina	20,012	25	20,037
Ohio	5,311,674	4,736,887	10,048,561
Oregon	(*a*)	(*a*)	(*a*)
Pennsylvania	816,612	848,400	1,665,012
South Carolina	11,847	25	11,872
Tennessee	64,093	....	64,093
Texas	90,486	700	91,186
Utah	(*a*)	....	(*a*)
Virginia	4,047	....	4,047
Washington	17,500	....	17,500
West Virginia	297,842	560,800	858,642
Wisconsin	9,900	3,500	13,400
Other States [b]	58,003	18,485	76,488
Total	14,125,182	8,338,678	22,463,860
Per cent of total	62.88	37.12	100.00

[a] Included in Other States.

[b] Includes all products made by less than three producers in one State, in order that the operations of individual establishments may not be disclosed.

Value of the pottery products of the United States in 1900.

State.	Plain.	Decorated.	Total.
Alabama	$20,046	$250	$20,296
Arkansas	26,280	....	26,280
California	24,387	....	24,387
Colorado	[a] 17,944	....	17,944
Connecticut	36,250	25,000	61,250
District of Columbia	10,873	....	10,873
Florida	(b)	....	....
Georgia	[b] 24,233	150	24,383
Idaho	(a)	....	....
Illinois	708,273	68,500	776,773
Indiana	278,374	47,526	325,900
Iowa	36,489	100	36,589
Kansas	14,061	....	14,061
Kentucky	131,497	....	131,497
Louisiana	2,900	1,400	4,300
Maine	(c)	....	....
Maryland	141,082	295,535	436,617
Massachusetts	[c] 171,312	67,412	238,724
Michigan	34,317	....	34,317
Minnesota	[e] 289,795	3,600	293,395
Mississippi	14,116	336	14,452
Missouri	71,474	....	71,474
Montana	(a)	....	....
New Hampshire	(d)	....	....
New Jersey	[d] 3,820,948	1,442,703	5,263,651
New York	[f] 931,597	233,728	1,165,325
North Carolina	18,435	428	18,863
Ohio	5,131,183	3,442,140	8,573,323
Oregon	17,290	....	17,290
Pennsylvania	1,023,773	367,100	1,390,873
South Carolina	17,633	....	17,633
Tennessee	48,855	800	49,655
Texas	87,464	....	87,464
Utah	6,600	....	6,600
Virginia	2,910	200	3,110
Washington	9,430	....	9,430
West Virginia	222,949	408,892	631,841
Wisconsin	(e)	....	....
Total	13,392,770	6,405,800	19,798,570
Per cent of total	67.65	32.35	100.00

[a] Value of the pottery products of Idaho and Montana is included with that of Colorado.
[b] Value of the pottery products of Florida is included with that of Georgia.
[c] Value of the pottery products of Maine is included with that of Massachusetts.
[d] Value of the pottery products of New Hampshire is included with that of New Jersey.
[e] Value of the pottery products of Wisconsin is included with that of Minnesota.
[f] Includes plain china for Ohio.

It will be seen from these tables that while decorated ware is reported from twenty-four States, in only nine was the product valued at $10,000 or over. New Jersey, Ohio, and Pennsylvania were, of course, the largest producers, these three States producing $7,124,233 out of the total value of $8,338,678 for this product. It will be noted that the plain ware aggregated $14,125,182 in value, or 62.88 per cent, and that the decorated ware was valued at $8,338,678, or 37.12 per cent of the total. In 1900 the decorated ware was valued at $6,405,800, or 32.35 per cent of the product, and the plain ware was valued at $13,392,770 in that year, or 67.65 per cent. This was a gain of $732,412 in the value of the plain ware, or 5.47 per cent, and of $932,878 in the value of the decorated ware, or 14.56 per cent, indicating a slight gain in the demand for decorated American ware.

The following table shows the value of the pottery products in the United States, by varieties, decorated and plain, in 1901:

Value of pottery products in the United States in 1901, by varieties.

	Plain (value).	Decorated (value).	Total value.	Number of producers.	Per centage of pottery product.
Red earthenware	$591,388	$173,060	$764,448	198	3.40
Stoneware	2,568,297	80,129	2,648,426	266	11.79
Yellow, or Rockingham ware	233,600	75,000	308,600	14	1.37
C. C. ware	985,208	452,255	1,437,463	20	6.40
White granite and semiporcelain ware.	2,753,489	2,927,276	5,680,765	38	25.29
Semivitreous porcelain ware	1,549,242	2,941,428	4,490,670	22	19.99
China	737,392	616,436	1,353,828	10	6.03
Bone china, delft and belleek ware	237,835	32,861	270,696	3	1.21
Sanitary ware	2,760,130	117,550	2,877,680	19	12.81
Porcelain electrical supplies	1,141,362	....	1,141,362	23	5.08
Miscellaneous[a]	567,239	922,683	1,489,922	67	6.63
Total value	14,125,182	8,338,678	22,463,860	....	....
Per cent of total	62.88	37.12	100.00	....	....

[a] Including art and chemical pottery, casters, cuspidors, enameled earthenware and terra cotta, faience ware, flemish ware, jardinieres and pedestals, lead pots, pins, stilts, and spurs for potters' use, porcelain door, picture, and shutter knobs, porcelain filter tubes, shuttle eyes and thread guides, porcelain hardware trimmings, smoking pipes, toy marbles, umbrella stands, washboards, white earthenware, and white-lined earthenware.

It will be noticed that the figures here given do not quite agree with those given on page 34. This is accounted for by the fact that in the former table it has been necessary to combine some of the products in order to prevent disclosing individual returns. The figures given in this table, however, are accurate and represent the actual value of these varieties of pottery in the United States, as reported to this office, though the figures given in the former table are as accurate as can be given for the State totals. It will be noted by this table that 62.88 per cent of the total product was plain and 37.12 per cent was decorated.

The product of greatest value is the white granite ware, which reached a value of $5,680,765, or 25.29 per cent of the total. The product of next greatest value was that reported as semivitreous ware, which amounted to $4,490,670, or 19.99 per cent of the total; and c. c. ware to the value of $1,437,463, or 6.40 per cent of the total, was reported by 20 producers.

The white ware, including that made for sanitary purposes and porcelain electrical supplies, aggregated in value $17,252,464, or 76.80 per cent of the total. The yellow, or rockingham ware showed, for the first time in several years, an increase in value, from $215,279 in

1900 to $308,600 in 1901. While the stoneware product is reported by more operators—266—than any other product, thus showing a wider distribution than any other, the product is a minor one, being valued in 1901 at $2,648,426, or 11.79 per cent of the total product. This is an increase of $201,089 over 1900, when it was valued at $2,447,337, a gain of 8.21 per cent. It is interesting to note the number of firms reporting the various grades of ware, ranging from 3 reporting bone china, delft, and belleek ware to 266 reporting stoneware. The total of this column, however, should not be taken for the number of firms reporting, as most firms make more than one kind of ware.

RANK OF STATES.

The following tables show the rank of States in the production of pottery, together with the value of the product of each State and the percentage of the total product made by each State in 1900 and 1901, and the number of firms reporting in each State:

Rank of States and output of pottery products in 1901.

Rank.	State.	Number of firms reporting.	Value.	Per cent of total product.
1	Ohio	109	$10,048,561	44.73
2	New Jersey	50	5,900,073	26.26
3	Pennsylvania	48	1,665,012	7.41
4	New York	25	1,077,360	4.80
5	West Virginia	9	858,642	3.82
6	Illinois	23	682,449	3.04
7	Indiana	14	531,371	2.37
8	Maryland	9	333,480	1.48
9	Minnesota	2	292,095	1.30
10	Massachusetts	18	281,368	1.25
11	Kentucky	10	139,697	.62
12	Connecticut	5	91,200	.41
13	Texas	26	91,186	.41
14	Missouri	16	64,647	.29
15	Tennessee	16	64,093	.29
16	Michigan	5	44,865	.20
17	California	10	33,434	.15
18	Colorado	4	26,700	.12
19	Iowa	8	26,520	.12
20	North Carolina	33	20,037	.09
21	Alabama	22	18,362	.08
22	Washington	5	17,500	.08
23	Georgia	18	17,230	.07
24	Wisconsin	4	13,400	.06
25	District of Columbia	3	12,879	.06
26	South Carolina	12	11,872	.05
27	Arkansas	5	11,405	.05
28	Mississippi	6	4,779	.02
29	Virginia	4	4,047	.02
30	Louisiana	3	3,108	.01
	Florida, Kansas, Maine, Montana, New Hampshire, Oregon, and Utah	10	76,488	.34
	Total	532	22,463,860	100.00

Rank of States and output of pottery products in 1900.

Rank.	State.	Number of firms reporting.	Value.	Per cent of total product.
1	Ohio	113	$8,573,323	43.30
2	New Jersey[a]	44	5,263,651	26.59
3	Pennsylvania	47	1,390,873	7.03
4	New York[b]	25	1,165,325	5.89
5	Illinois	29	776,773	3.92
6	West Virginia	6	631,841	3.19
7	Maryland	8	436,617	2.21
8	Indiana	15	325,900	1.65
9	Minnesota[c]	6	293,395	1.48
10	Massachusetts[d]	19	238,724	1.21
11	Kentucky	10	131,497	.66
12	Texas	24	87,464	.44
13	Missouri	18	71,474	.36
14	Connecticut	5	61,250	.31
15	Tennessee	19	49,655	.25
16	Iowa	7	36,589	.18
17	Michigan	4	34,317	.17
18	Arkansas	7	26,280	.13
19	California	10	24,387	.12
20	Georgia[e]	26	24,383	.12
21	Alabama	27	20,296	.10
22	North Carolina	39	18,863	.10
23	Colorado[f]	6	17,944	.09
24	South Carolina	13	17,633	.09
25	Oregon	3	17,290	.09
26	Mississippi	7	14,452	.07
27	Kansas	3	14,061	.07
28	District of Columbia	3	10,873	.06
29	Washington	5	9,430	.05
30	Utah	4	6,600	.03
31	Louisiana	3	4,300	.02
32	Virginia	6	3,110	.02
	Total	561	19,798,570	100.00

[a] Includes New Hampshire.
[b] Includes electrical supplies made in Indiana and china made in Ohio.
[c] Includes Wisconsin.
[d] Includes Maine.
[e] Includes Florida.
[f] includes Idaho and Montana.

Ohio continues to lead in the pottery industry, both as to number of producers and value of product, producing ware valued at $10,048,561 in 1901, or 44.73 per cent of the total for the country in that year, as compared with $8,573,323 in 1900, a gain of $1,475,238, or 17.21 per cent. New Jersey, Pennsylvania, and New York held second, third, and fourth places, respectively, in both years. New Jersey's product increased from $5,263,651 in 1900 to $5,900,073 in 1901, an increase of $636,422, or 12.09 per cent. Pennsylvania increased her product from $1,390,873 in 1900 to $1,665,012, in 1901 a gain of $274,139, or 19.7 per cent. This percentage of gain is not quite so great as that of West Virginia, which rose from $631,841 in 1900 to $858,642 in 1901, a gain of 35.89 per cent.

The following table gives the number of potteries reporting during the years 1898 to 1901, inclusive, showing those idle and those operating:

Number of operating and idle potteries in the United States reporting in 1898, 1899, 1900, and 1901.

State.	1898.			1899.	1900.			1901.		
	Operating.	Idle.	Total.	Operating.	Operating.	Idle.	Total.	Operating.	Idle.	Total.
Alabama	8	3	11	30	27	3	30	22	2	24
Arkansas	4	2	6	8	7	0	7	5	0	5
California	5	3	8	13	10	3	13	10	2	12
Colorado	....	......	....	4	3	0	3	4	1	5
Connecticut	5	0	5	4	5	0	5	5	0	5
District of Columbia	....	......	....	3	3	0	3	3	0	3
Florida	....	......	....	1	1	0	1	1	0	1
Georgia	6	2	8	30	25	1	26	18	3	21
Idaho	....	......	....	1	2	0	2	0	1	1
Illinois	23	4	27	28	29	0	29	24	3	27
Indiana	18	4	22	21	15	2	17	14	1	15
Iowa	15	0	15	12	7	0	7	8	3	11
Kansas	4	1	5	4	3	1	4	1	2	3
Kentucky	10	2	12	10	10	0	10	11	1	12
Louisiana	....	......	....	3	3	1	4	3	1	4
Maine	....	......	....	2	1	1	2	2	0	2
Maryland	8	1	9	9	8	1	9	10	0	10
Massachusetts	15	2	17	18	18	1	19	18	0	18
Michigan	3	0	3	4	4	0	4	5	0	5
Minnesota	3	1	4	4	3	0	3	2	0	2
Mississippi	....	......	....	11	7	0	7	6	0	6
Missouri	9	3	12	21	18	2	20	16	1	17
Montana	....	......	....	1	1	0	1	1	0	1
Nebraska	....	......	....	1	0	1	1	0	1	1
New Hampshire	....	......	....	1	1	0	1	1	0	1
New Jersey	44	3	47	46	43	2	45	50	2	52
New York	22	2	24	25	25	2	27	25	1	26
North Carolina	28	0	28	47	39	4	43	33	4	37
Ohio	108	9	117	118	113	6	119	109	8	117
Oregon	....	......	....	3	3	0	3	2	0	2
Pennsylvania	39	2	41	50	47	3	50	48	3	51
South Carolina	4	1	5	15	13	1	14	12	0	12
Tennessee	16	1	17	19	19	1	20	16	1	17
Texas	18	0	18	27	24	1	25	26	3	29
Utah	....	......	....	4	4	1	5	2	0	2
Virginia	8	3	11	6	6	3	9	4	3	7
Washington	....	......	....	6	5	3	8	5	0	5
West Virginia	5	1	6	6	6	2	8	9	0	9
Wisconsin	....	......	....	3	3	0	3	4	0	4
Other States[a]	19	3	22	....	....	......	....	....	......	....
Total	447	53	500	619	561	46	607	535	47	582

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[a] Including in 1898 Colorado, District of Columbia, Florida, Idaho, Louisiana, Maine, Mississippi, Montana, Nebraska, New Hampshire, Oregon, Utah, and Wisconsin.

In the consideration of the number of potteries reporting, the same condition obtains as in the brick and tile industry—the consolidation of plants apparently reduces the number of firms reporting, while the actual number of plants making the higher grades is increasing constantly, the States showing losses, except those explained by consolidations, being largely in the stoneware and earthenware producing regions.

TRENTON N. J., AND EAST LIVERPOOL, OHIO.

The following table gives the value of the pottery products of the great pottery centers of Trenton, N. J., and East Liverpool, Ohio, in 1900 and 1901:

Pottery products of Trenton, N. J., and East Liverpool, Ohio, in 1901.

Product.	Trenton (value).	East Liverpool (value).	Total value.
Yellow or rockingham ware	....	(a)	....
C. C. ware	$443,455	$612,074	$1,055,529
White granite ware	1,485,263	2,110,446	3,595,709
Semivitreous porcelain ware	225,962	1,950,574	2,176,536
China	660,948	(a)	660,948
Bone china, delft, and belleek ware	270,696	....	270,696
Sanitary ware	1,788,030	....	1,788,030
Porcelain electrical supplies	339,279	(a)	339,279
Miscellaneous [b]	106,060	[c] 633,563	739,623
Total	5,319,693	5,306,657	10,626,350
Per cent of total pottery product	23.68	23.62	47.30

[a] Included in miscellaneous in order to prevent disclosing the operations of individual establishments.

[b] Including stilts, pins, and spurs for potters' use, porcelain casters and door knobs, and toy marbles.

[c] Also includes yellow or rockingham ware, china, and porcelain electrical supplies.

Pottery products of Trenton, N. J., and East Liverpool, Ohio, in 1900.

Product.	Trenton (value).	East Liverpool (value).	Total value.
Yellow or rockingham ware	....	$90,261	$90,261
C. C. ware	$526,249	757,434	1,283,683
White granite ware	1,139,620	2,036,686	3,176,306
Semivitreous porcelain ware	375,926	1,211,104	1,587,030
China	577,593	(a)	577,593
Bone china, delft, and belleek ware	65,800	....	65,800
Sanitary ware	1,594,447	....	1,594,447
Porcelain electrical supplies	285,466	(a)	285,466
Miscellaneous [b]	310,889	[c] 507,629	818,518
Total	4,875,990	4,603,114	9,479,104

[a] Included in miscellaneous.

[b] Including stilts, pins, and spurs for potters' use; porcelain door, shutter, and picture knobs kitchen sinks, lavatories, etc.

[c] Also includes red earthenware, china, and porcelain electrical supplies.

CLAY.

PRODUCTION.

In compiling these figures only the clay sold by the miner has been considered, that which is manufactured by the producer not being taken into account.

In the following table will be found a statement of the clay mined and sold in the United States in 1900 and 1901:

Production and value of clay in the United States in 1901, by States

[Quantity in tons of 2,000 pounds.]

State.	Kaolin.				Ball clay.			
	Raw.		Prepared.		Raw.		Prepared.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Alabama	(*b*)	(*b*)	....	....	....	....	....	....
Arizona [a]	260	$965	12,900	$75,000	....	....	....	....
California	....	....	....	....	....	....	....	....
Colorado	(*b*)	(*b*)	....	....	....	....	....	....
Delaware	....	....	14,051	110,883	....	....	....	....
Georgia	8,280	41,400	415	2,715	....	....	....	....
Illinois	....	....	....	....	....	....	....	....
Indiana	....	....	....	....	....	....	....	....
Kentucky	....	....	....	....	8,900	$29,700	....	....
Maryland	....	....	....	....	....	....	....	....
Massachusetts	(*b*)	(*b*)	(*b*)	(*b*)	....	....	....	....
Missouri	1,670	4,495	(*b*)	(*b*)	(*b*)	(*b*)	....	....
Montana	....	....	....	....	....	....	....	....
New Jersey	3,541	4,040	....	....	(*b*)	(*b*)	(*e*)	(*e*)
New York	(*d*)	(*d*)	....	....	....	....	....	....
North Carolina	....	....	11,616	107,222	....	....	....	....
Ohio	....	....	....	....	....	....	....	....
Pennsylvania	4,625	8,637	15,422	97,254	....	....	....	....
South Carolina	(*b*)	(*b*)	....	....	....	....	....	....
Tennessee	910	1,192	....	....	(*b*)	(*b*)	....	....
Texas	....	....	....	....	....	....	....	....
West Virginia	....	....	....	....	....	....	....	....
Wisconsin	....	....	(*b*)	(*b*)	(*b*)	(*b*)	....	....
Other States [c]	18,170	81,170	5,393	49,550	12,108	39,207	....	....
Total	37,456	141,899	59,797	442,624	21,008	68,907	....	....

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[a] Including Connecticut, Florida, Michigan, New Hampshire, North Dakota, Oregon, Utah, Vermont, Virginia, and Washington.

[b] Included in Other States.

[c] Including all products made by less than three operators in one State, in order that the operations of individual establishments may not be disclosed.

[d] Raw kaolin for New York included in New York miscellaneous.

[e] Prepared ball clay for New Jersey included in New Jersey miscellaneous.

Production and value of clay in the United States in 1901, by States—Continued.

[Quantity in tons of 2,000 pounds.]

State.	Fire clay.				Stoneware clay.			
	Raw.		Prepared.		Raw.		Prepared.	
	Quantity.	Value.	Quantity.	Value.	Quantity	Value.	Quantity.	Value.
Alabama	31,512	$15,758	(b)	(b)	(b)	(b)	....	....
Arizona[a]	....	....	1,429	$13,286	400	$738	....	....
California	13,676	8,396	(b)	(b)	(b)	(b)	....	....
Colorado	(b)	(b)	(b)	(b)	(b)	(b)	....	....
Delaware	....	....	(d)	(d)	....	....	....	....
Georgia	(b)	(b)	....	....	(b)	(b)	....	....
Illinois	38,000	31,200	5,261	3,403	21,051	17,855	....	....
Indiana	16,546	14,396	(b)	(b)	4,099	4,509	(b)	(b)
Kentucky	(b)	(b)	(b)	(b)	(b)	(b)	....	....
Maryland	3,828	2,628	....	....	3,283	3,780	....	....
Massachusetts	(b)	(b)	....	....	(b)	(b)	....	....
Missouri	126,771	123,857	15,806	151,531	2,677	2,187	(b)	(b)
Montana	(b)	(b)	(b)	(b)	....	....	....	....
New Jersey	225,424	328,370	16,023	63,579	26,538	46,290	(b)	(b)
New York	25,565	51,730	....	....	1,234	1,500	....	....
North Carolina	....	....	....	....	795	405	....	....
Ohio	93,961	69,910	64,471	61,172	19,199	15,173	....	....
Pennsylvania	60,812	57,508	51,459	149,797	2,796	2,343	....	....
South Carolina	....	....	(b)	(b)	....	....	....	....
Tennessee	(b)	(b)	....	....	(b)	(b)	....	....
Texas	(b)	(b)	(b)	(b)	(b)	(b)	....	....
West Virginia	(e)	(e)	64,995	256,694	....	....	....	....
Wisconsin	....	....	....	....	....	....	....	....
Other States[c]	44,698	43,203	29,512	68,090	5,757	6,973	4,400	$12,860
Total	680,793	746,956	248,956	767,552	87,829	101,753	4,400	12,860

[a] Including Connecticut, Florida, Michigan, New Hampshire, North Dakota, Oregon, Utah, Vermont, Virginia, and Washington.

[b] Included in Other States.

[c] Including all products made by less than three operators in one State, in order that the operations of individual establishments may not be disclosed.

[d] Prepared fire clay for Delaware included in Delaware miscellaneous.

[e] Raw fire clay for West Virginia included in West Virginia miscellaneous.

Production and value of clay in the United States in 1901, by States—Continued.

[Quantity in tons of 2,000 pounds.]

State.	Miscellaneous.[a]				Total.	
	Raw.		Prepared.			
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Alabama					34,932	$18,698
Arizona[b]	615	$905	1,000	$3,000	16,604	93,894
California	13,288	12,460			28,085	22,535
Colorado	19,488	17,539	12,963	11,201	59,113	59,774
Delaware			[c] 500	[c] 2,000	14,551	112,883
Georgia					8,832	44,315
Illinois	20,891	10,673			85,203	63,131
Indiana					30,745	25,705
Kentucky	56	280			24,719	43,004
Maryland	4,300	1,600			11,411	8,008
Massachusetts	575	575			2,505	9,680
Missouri	2,822	2,259			154,266	295,333
Montana			75	300	18,675	55,205
New Jersey	109,260	96,510	[e] 7,360	[e] 38,908	392,946	594,894
New York	[d] 2,900	[d] 6,450			29,699	59,680
North Carolina					12,411	107,627
Ohio	182	168	3,278	6,362	181,091	152,785
Pennsylvania			9,433	17,892	144,547	333,431
South Carolina	16,000	63,000			33,168	143,700
Tennessee	1,300	1,550			12,880	32,957
Texas					839	1,384
West Virginia	[f] 200	[f] 100	245	549	65,440	257,343
Wisconsin	200	100			4,508	40,966
Other States[g]					([h])	([h])
Total	192,077	214,169	34,854	80,212	1,367,170	2 576,932

[a] Including brick clay, clay for boiler covering and wall paper, pipeclay, paper clay, silica clay, slip clay, and terra-cotta clay.

[b] Including Connecticut, Florida, Michigan, New Hampshire, North Dakota, Oregon, Utah, Vermont, Virginia, and Washington.

[c] Includes prepared fire clay for Delaware.

[d] Includes 1,500 tons of Albany slip clay valued at $5,000; also includes raw kaolin for New York.

[e] Includes prepared ball clay for New Jersey.

[f] Includes raw fire clay for West Virginia.

[g] Including all products made by less than three operators in one State, in order that the operations of individual establishments may not be disclosed,

[h] The total of Other States is distributed among the States to which it belongs, in order that they may be fully represented in the totals.

Production and value of clay in the United States in 1900, by States.

[Quantity in tons of 2,000 pounds.]

State.	Kaolin.				Ball clay.			
	Raw.		Prepared.		Raw.		Prepared.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Alabama	(a)	(a)	....	....	....	....	....	....
Arizona [b]	494	$907	10,280	$63,600	....	....	....	....
California	....	....	....	....	....	....	....	....
Colorado	(a)	(a)	....	....	....	....	....	....
Delaware	....	....	12,357	102,005	....	....	....	....
Georgia	(a)	(a)	(a)	(a)	....	....	....	....
Illinois	....	....	....	....	....	....	....	....
Indiana	....	....	....	....	....	....	....	....
Iowa	....	....	....	....	....	....	....	....
Kentucky	....	....	....	....	7,754	$26,039	....	....
Maryland	....	....	....	....	....	....	....	....
Massachusetts	....	....	....	....	....	....	....	....
Michigan	728	1,275	....	....	....	....	....	....
Missouri	2,545	6,640	(a)	(a)	(a)	(a)	....	....
Montana	....	....	....	....	....	....	....	....
New Jersey	2,986	2,456	....	....	(a)	(a)	(a)	(a)
New York	(a)	(a)	....	....	....	....	(a)	(a)
North Carolina	(a)	(a)	3,224	28,729	....	....	....	....
Ohio	....	....	....	....	....	....	....	....
Pennsylvania	(a)	(a)	5,834	44,507	....	....	....	....
South Carolina	(a)	(a)	....	....	....	....	....	....
Tennessee	(a)	(a)	....	....	(a)	(a)	....	....
Texas	(a)	(a)	....	....	....	....	....	....
West Virginia	....	....	....	....	....	....	....	....
Wisconsin	....	....	(a)	(a)	....	....	....	....
Other States [c]	15,801	96,942	5,865	50,225	6,222	27,811	7,405	$38,133
Total	22,554	108,220	37,560	289,066	13,976	53,850	7,405	38,133

[a] Included in Other States.

[b] Including Connecticut, Florida, Maine, Mississippi, New Hampshire, New Mexico, North Dakota, Oregon, Utah, Vermont, Virginia, and Washington.

[c] Including all products made by less than three producers in one State, in order that the operations of individual establishments may not be disclosed.

Production and value of clay in the United States in 1900, by States—Continued.

[Quantity in tons of 2,000 pounds.]

State.	Fire clay.				Stoneware clay.			
	Raw.		Prepared.		Raw.		Prepared.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Alabama	20,294	$11,205	(a)	(a)	(a)	(a)	....	....
Arizona [b]	1,362	4,872	....	....	650	$635	....	....
California	4,932	5,698	(a)	(a)	....	....	....	....
Colorado	21,178	22,930	(a)	(a)	(a)	(a)	....	....
Delaware	....	....	....	....	....	....	....	....
Georgia	....	....	....	....	(a)	(a)	....	....
Illinois	18,605	16,069	(a)	(a)	26,416	21,643	(a)	(a)
Indiana	23,272	18,165	....	....	2,000	1,850	....	....
Iowa	1,140	840	(a)	(a)	....	....	....	....
Kentucky	(a)	(a)	(a)	(a)	(a)	(a)	....	....
Maryland	(a)	(a)	....	....	(a)	(a)	....	....
Massachusetts	(a)	(a)	....	....	....	....	....	....
Michigan	....	....	....	....	....	....	....	....
Missouri	93,560	78,154	13,583	$113,940	1,735	1,490	(a)	(a)
Montana	(a)	(a)	(a)	(a)	....	....	....	....
New Jersey	210,635	272,707	(a)	(a)	16,621	29,189	....	....
New York	(a)	(a)	....	....	(a)	(a)	(a)	(a)
North Carolina	(a)	(a)	(a)	(a)	292	127	....	....
Ohio	90,782	71,726	29,374	27,952	36,523	25,200	(a)	(a)
Pennsylvania	86,622	121,885	42,044	57,557	1,957	640	(a)	(a)
South Carolina	(a)	(a)	....	....	....	....	....	....
Tennessee	1,991	2,697	....	....	908	808	....	....
Texas	(a)	(a)	....	....	367	435	....	....
West Virginia	124,000	46,700	37,051	29,858	....	....	....	....
Wisconsin	....	....	(a)	(a)	....	....	....	....
Other States [c]	16,030	12,279	9,104	32,759	1,346	1,826	4,714	$10,862
Total	714,403	685,927	131,156	262,066	88,815	83,843	4,714	10,862

[a] Included in Other States.

[b] Including Connecticut, Florida, Maine, Mississippi, New Hampshire, New Mexico, North Dakota, Oregon, Utah, Vermont, Virginia, and Washington.

[c] Including all products made by less than three producers in one State, in order that the operations of individual establishments may not be disclosed.

Production and value of clay in the United States in 1900, by States—Continued.

[Quantity in tons of 2,000 pounds.]

State.	Miscellaneous.[a]				Total.	
	Raw.		Prepared.			
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Alabama	....	....	....	....	21,454	$12,865
Arizona [b]	1,220	$1,124	....	....	14,006	71,138
California	7,065	7,310	....	....	12,879	16,313
Colorado	26,878	21,786	....	....	49,652	47,884
Delaware	....	....	....	....	12,357	102,005
Georgia	710	610	....	....	6,885	32,645
Illinois	16,204	11,945	2	$45	63,062	52,872
Indiana	2,300	1,130	....	....	27,572	21,145
Iowa	....	....	....	....	1,180	980
Kentucky	1,000	900	....	....	18,974	32,874
Maryland	25	6	....	....	2,502	2,378
Massachusetts	1,070	1,130	25	500	1,395	2,380
Michigan	....	....	....	....	728	1,275
Missouri	5,569	25,781	4,524	4,049	124,666	247,204
Montana	2,867	3,655	....	....	6,399	17,491
New Jersey	72,532	92,061	6,088	16,924	321,219	467,881
New York	[c] 2,720	[c] 8,360	....	....	4,990	13,410
North Carolina	40	20	....	....	10,166	89,536
Ohio	22,631	12,965	....	....	181,845	143,547
Pennsylvania	564	847	1,534	11,563	140,734	240,857
South Carolina	[d] 19,960	[d] 79,200	....	....	20,510	79,900
Tennessee	4,500	5,625	9	9	11,424	25,421
Texas	60	60	....	....	805	1,025
West Virginia	100	70	....	....	161,151	76,628
Wisconsin	880	735	....	....	5,105	40,723
Other States [e]	....	....	....	....	([f])	([f])
Total	188,895	275,320	12,182	33,090	1,221,660	1,840,377

[a] Including brick clay, clay for boiler covering, flint clay, glass-house pot clay, modeling clay, paper clay, pipe clay, plastic clay, slip clay, and terra-cotta clay.

[b] Including Connecticut, Florida, Maine, Mississippi, New Hampshire, New Mexico, North Dakota, Oregon, Utah, Vermont, Virginia, and Washington.

[c] Includes 2,700 tons of Albany slip clay, valued at $8,300.

[d] Paper clay.

[e] Including all products made by less than three producers in one State, in order that the operations of individual establishments may not be disclosed.

[f] The total of Other States is distributed among the States to which it belongs, in order that they may be fully represented in the totals.

This table shows that the total amount of clay mined and sold in 1901 was 1,367,170 short tons, valued at $2,576,932, as compared with 1,221,660 tons in 1900, worth $1,840,377. New Jersey continues to be the leading clay-mining State, its product being valued at $594,894, or 23.09 per cent of the total; in 1900 its product was valued at $467,881, or 25.42 per cent; in 1899 this State produced clay valued at $440,874, or 26.80 per cent of the total. Pennsylvania is second in rank, with a product valued at $333,431, or 12.94 per cent of the total, displacing Missouri, which was second in 1900, with a product valued at $247,204, or 13.43 per cent of the total, and third in 1901, with a product valued at $295,333, or 11.46 per cent of the total.

The following tables give the quantity and value of the clay mined in 1900 and 1901, by kinds and conditions in which sold:

Production of clay in the United States in 1901, by kinds.

	Raw.		Prepared.		Total.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Short tons.		*Short tons.*		*Short tons.*	
Kaolin	37,456	$141,899	59,797	$442,624	97,253	$584,523
Ball	21,008	68,907	(a)	(a)	21,008	68,907
Fire	680,793	746,956	248,956	767,552	929,749	1,514,508
Stoneware	87,829	101,753	4,400	12,860	92,229	114,613
Miscellaneous	192,077	214,169	34,854	80,212	226,931	294,381
Total	1,019,163	1,273,684	348,007	1,303,248	1,367,170	2,576,932

[a] Included in miscellaneous.

Production of clay in the United States in 1900, by kinds.

	Raw.		Prepared.		Total.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Short tons.		*Short tons.*		*Short tons.*	
Kaolin	22,554	$108,220	37,560	$289,066	60,114	$397,286
Ball	13,976	53,850	7,405	38,133	21,381	91,983
Fire	714,403	685,927	131,156	262,066	845,559	947,993
Stoneware	88,815	83,843	4,714	10,862	93,529	94,705
Pipe	42,407	35,604	125	530	42,532	36,134
Terra cotta	45,077	50,769	....	....	45,077	50,769
Miscellaneous	101,411	188,947	12,057	32,560	113,468	221,507
Total	1,028,643	1,207,160	193,017	633,217	1,221,660	1,840,377

Of the total production of 1,367,170 tons in 1901, 1,019,163 tons, or 74.55 per cent, were sold without any preparation whatever after mining, and 348,007 tons were washed, ground, or prepared in some other manner. The average value per ton for all clay was $1.88 while for the raw clay the average was $1.25, and for the prepared it was $3.74. The fire clay was the most important of these products, being valued at $1,514,508, or 58.77 per cent of the total, and the kaolin of domestic production was valued at $584,523, or 22.68 per cent of the total.

IMPORTS.

The following table gives the statistics of the imports of clay and clay wares into the United States for a series of years.

Classified imports of clay from 1885 to 1901, inclusive.

Calendar year.	Kaolin or china clay.		All other clays.						Total.	
			Unwrought.		Wrought.		Common blue.			
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Long tons.		*Long tons.*		*Long tons.*		*Long tons.*		*Long tons.*	
1885	10,626	$83,722	9,736	$76,899	3,554	$29,839	....	....	23,916	$190,460
1886	16,590	123,093	13,740	113,875	1,654	20,730	....	....	31,984	257,698
1887	23,486	141,360	17,645	139,405	2,187	22,287	....	....	43,318	303,052
1888	18,150	102,050	20,604	152,694	6,832	53,245	....	....	45,586	307,989
1889	19,843	113,538	19,237	145,983	8,142	64,971	....	....	47,222	324,492
1890	29,923	270,141	21,049	155,486	2,978	29,143	....	....	53,950	454,770
1891	39,901	294,458	16,094	118,689	6,297	56,482	....	....	62,292	469,629
1892	49,468	375,175	20,132	155,047	4,551	64,818	5,172	$59,971	79,323	655,011
1893	49,713	374,460	14,949	113,029	6,090	67,280	4,304	51,889	75,056	606,658
1894	62,715	465,501	13,146	98,776	4,768	60,786	2,528	28,886	83,157	653,949
1895	75,447	531,714	18,419	125,417	5,160	60,775	3,869	40,578	102,895	758,484
1896	76,718	536,081	13,319	88,029	4,514	56,701	4,983	54,695	99,534	735,506
1897	71,938	493,431	9,405	56,264	7,839	52,232	4,562	50,954	93,744	652,881
1898	85,586	573,595	16,130	98,434	1,412	24,959	5,312	58,280	108,440	755,268
1899	92,521	615,717	19,614	118,679	1,716	31,948	9,223	106,618	123,074	872,962
1900	111,959	698,720	21,626	126,203	8,195	45,431	7,327	92,013	144,107	962,367
1901	117,756	663,379	27,597	156,838	5,707	75,721	6,136	73,839	157,196	969,777

Value of earthenware, china, brick, and tile imported and entered for consumption in the United States, 1867 to 1901, inclusive.

Year ending—	Brown earthen and common stone ware.	China and porcelain, not decorated.	China and decorated porcelain.	Other earthen, stone, or crockery ware, glazed, etc.	Brick, fire brick, and tile.	Total.
June 30—						
1867	$48,618	$418,493	$439,824	$4,280,924	....	$5,187,859
1868	47,208	309,960	403,555	3,244,958	....	4,005,681
1869	34,260	400,894	555,425	3,468,970	....	4,459,549
1870	47,457	420,442	530,805	3,461,524	....	4,460,228
1871	96,695	391,374	571,032	3,573,254	....	4,632,355
1872	127,346	470,749	814,134	3,896,664	....	5,308,893
1873	115,253	479,617	867,206	4,289,868	....	5,751,944
1874	70,544	397,730	676,656	3,686,794	....	4,831,724
1875	68,501	436,883	654,965	3,280,867	....	4,441,216
1876	36,744	409,539	718,156	2,948,517	....	4,112,956
1877	30,403	326,956	668,514	2,746,186	....	3,772,059
1878	18,714	389,133	657,485	3,031,393	....	4,096,725
1879	19,868	296,591	813,850	2,914,567	....	4,044,876
1880	31,504	334,371	1,188,847	3,945,666	....	5,500,388
1881	27,586	321,259	1,621,112	4,413,369	....	6,383,326
1882	36,023	316,811	2,075,708	4,438,237	....	6,866,779
1883	43,864	368,943	2,587,545	5,685,709	....	8,686,061
1884	50,172	982,499	2,664,231	(a)	$666,595	4,363,497
1885	44,701	823,334	2,834,718	....	963,422	4,666,175
December 31—						
1886	37,820	865,446	3,350,145	....	951,293	5,204,704
1887	43,079	967,694	3,888,509	....	1,008,360	5,907,642
1888	55,558	1,054,854	4,207,598	....	886,314	6,204,324
1889	48,824	1,148,026	4,580,321	....	788,391	6,565,562
1890	56,730	974,627	3,562,851	....	563,568	5,157,776
1891	99,983	1,921,643	6,288,088	....	353,736	8,663,450
1892	63,003	2,022,814	6,555,172	....	380,520	9,021,509
1893	57,017	1,732,481	6,248,255	....	338,143	8,375,896
1894	47,114	1,550,950	5,392,648	....	189,631	7,180,343
1895	61,424	2,117,425	8,055,473	....	211,473	10,445,795
1896	41,585	1,511,542	7,729,942	....	247,455	9,530,524
1897	[b]32,227	1,406,019	7,057,261	....	146,668	8,642,175
1898	[b]54,672	1,002,729	5,905,209	....	117,324	7,079,934
1899	[b]40,164	1,125,892	6,740,884	....	134,691	8,041,631
1900	[b]65,214	1,059,152	7,617,756	....	169,951	8,912,073
1901	[b]51,551	1,094,078	8,385,514	....	150,268	9,681,411

[a] Not separately classified after 1883.

[b] Including rockingham ware.

EXPORTS.

The following table gives the statistics of the clay wares exported from the United States from 1895 to 1901. It will be noticed that they have fallen off slightly in every grade, but the total value of the exports was above $1,000,000.

Exports of clay wares from the United States from 1895 to 1901, inclusive.

Year.	Brick.				Pottery.			Grand total (value).
	Building.		Fire (value).	Total (value).	Earthen and stone ware (value).	China (value).	Total (value).	
	Quantity	Value.						
	Thousands.							
1895	4,757	$34,732	$88,729	$123,461	$114,425	$24,872	$139,297	$262,758
1896	5,258	32,759	102,636	135,395	144,641	24,702	169,343	304,738
1897	4,606	30,383	110,626	141,009	177,320	30,283	207,603	348,612
1898	4,708	32,317	146,632	178,949	212,769	39,052	251,821	430,770
1899	9,872	77,783	214,375	292,158	467,925	43,807	511,732	803,890
1900	12,526	128,800	594,237	723,037	489,942	68,852	558,794	1,281,831
1901	9,072	74,210	467,379	541,589	476,957	49,863	526,820	1,068,409

CEMENT.[a]

PORTLAND CEMENT.

PRODUCTION.

For the calendar year ending December 31, 1901, the production of Portland cement in the United States was 12,711,225 barrels, an increase of 4,229,205 barrels, or 50 per cent, over the production of 1900; it was valued at $12,532,360. The increase in this production was not unexpected, it having been predicted in the report on cement made by the Survey last year.

Following is the table showing the production, by States, of Portland cement in the United States in 1899, 1900, and 1901:

Production of Portland cement in the United States in 1899, 1900, and 1901.

State.	1899.			1900.		
	Number of works.	Product.	Value, not including packages.	Number of works.	Product.	Value, not including packages.
		Barrels.			*Barrels.*	
Arkansas	1	50,000	$87,500	1	40,000	$70,000
California	1	60,000	120,000	1	44,565	89,130
Colorado	....	....	....	1	35,708	71,416
Illinois	2	53,000	79,500	3	240,442	300,552
Indiana	....	....	....	1	30,000	37,500
Kansas	....	....	....	1	80,000	100,000
Michigan	4	342,566	513,849	6	664,750	830,940
New Jersey	2	892,167	1,338,250	2	1,169,212	1,169,212
New Mexico	1	1,500	4,500	....	....	....
New York	7	472,386	708,579	8	465,832	582,290
North Dakota	1	1,700	5,100	1	400	1,200
Ohio	6	480,982	721,473	6	534,215	667,769
Pennsylvania	9	3,217,965	4,290,620	14	4,984,417	4,984,417
South Dakota	1	35,000	70,000	1	38,000	76,000
Texas	....	....	....	2	26,000	52,000
Utah	1	45,000	135,000	1	70,000	175,000
Virginia	....	....	....	1	58,479	73,099
Total	36	5,652,266	8,074,371	50	8,482,020	9,280,525

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[a] The entire statistical canvass and compilation of this report has been conducted by L. L. Kimball, of the United States Geological Survey.—EDITOR.

Production of Portland cement in the United States in 1899, 1900, and 1901—Continued.

State.	1901.		
	Number of works.	Product.	Value, not including packages.
		Barrels.	
Arkansas	1	....	....
California	[a] 1	146,848	$513,968
Colorado	[b] 1	585,000	643,500
Illinois	4	528,925	581,818
Indiana	2	218,402	240,242
Kansas	1	....	....
Michigan	10	1,025,718	1,128,290
New Jersey	3	1,612,000	1,450,800
New Mexico	....	....	....
New York	7	617,228	617,228
North Dakota	1	....	....
Ohio	[c] 7	689,852	758,837
Pennsylvania	13	7,091,500	6,382,350
South Dakota	1	....	....
Texas	[d] 2	195,752	215,327
Utah	1	....	....
Virginia	1	....	....
Total	56	12,711,225	12,532,360

[a] Includes product of the single plant in Utah.
[b] Includes product of the only Portland-cement plant in Kansas.
[c] Includes product of the only Portland-cement plant in Virginia.
[d] Includes product of the single plant in South Dakota.

In compiling the figures for 1901 in the above table North Dakota has been left blank, as the plant in that State has classed its output for this year under natural-rock cement. The firm expects, however, to put a Portland cement on the market later. Also, in the States where there is but a single plant, the product has been combined with that of some other State, to avoid publishing individual figures.

Following is a table showing the relative increase in the production of Portland cement in the more important sections of the country during the last twelve years:

Development of the Portland-cement industry in the United States since 1890.

Section.	1890.			1894.			1899.		
	Number of works.	Product.	Per cent.	Number of works.	Product.	Per cent.	Number of works.	Product.	Per cent.
		Barrels.			*Barrels.*			*Barrels.*	
New York	4	65,000	19.4	4	117,275	14.7	7	472,386	8.4
Lehigh and Northampton counties, Pa., and Warren County, N. J.	5	201,000	60.0	7	485,329	60.8	11	4,110,132	72.7
Ohio	2	22,000	6.5	4	80,653	10.1	6	480,982	8.5
Michigan	....	....	....	....	....	....	4	342,566	6.1
All other sections	5	47,500	14.1	9	115,500	14.4	8	246,200	4.3
Total	16	335,500	100.0	24	798,757	100.0	36	5,652,266	100.0

Development of the Portland-cement industry in the United States since 1890—Continued.

Section.	1900.			1901.		
	Number of works.	Product.	Per cent.	Number of works.	Product.	Per cent.
		Barrels.			*Barrels.*	
New York	8	465,832	5.5	7	617,228	4.8
Lehigh and Northampton counties, Pa., and Warren County N. J	15	6,153,629	72.6	16	8,595,340	67.7
Ohio	6	534,215	6.3	7	689,852	5.4
Michigan	6	664,750	7.8	10	1,025,718	8.0
All other sections	15	663,591	7.8	16	1,783,087	14.1
Total	50	8,482,020	100.0	56	12,711,225	100.0

Although the percentage of New York's production of Portland cement to the whole is smaller this year than last, the State production of Portland was larger. The greater part of the production from this State is natural-rock cement, for which there is a steady market; there are, however, five plants in the State devoted exclusively to the production of Portland cement, while two other companies manufacture both Portland and natural-rock cement. Of the 30 companies reporting from the State in 1901, 3 had plants that were idle during part of the year, 1 was out of business, and 4 were in process of building. The Empire Portland Cement Company, at Warners, N. Y., had the misfortune to have its plant destroyed by fire early in 1902. Of the companies reporting as to the kind of kiln used, 19 had plants using vertical kilns, and 6 used the rotary kiln. All the new plants will use rotary kilns.

Pennsylvania had 7 companies manufacturing Portland cement exclusively in 1901, 6 that produced both natural-rock and Portland, 1 that made only natural-rock cement, 4 plants that were new, and 3 idle, of which 2 were shut down for reconstruction and remodeling. One company is erecting its third large plant in Pennsylvania, besides building a plant of enormous capacity in another State.

In New Jersey there were 3 plants manufacturing Portland cement, and 3 new plants were being built. The amount of cement produced in this section, i. e., Pennsylvania and New Jersey, exceeds that of any previous year notwithstanding the fact that several plants in Pennsylvania were unproductive. In New Jersey only rotary kilns are at present reported; in Pennsylvania those mills making both Portland and natural-rock cement report the use of both rotary and vertical kilns, those making only Portland use only rotary kilns, and those making or about to make natural-rock cement report only the vertical kilns.

In Ohio 7 plants reported as having produced Portland cement exclusively, 1 plant reported a product of natural-rock cement, 1 reported slag cement only, 2 were out of business, 1 was idle, and 1 at Ironton newly erected, in 1901. The new plant at Wellston was already a successful producer. There is but 1 company in the State that reports the use of both rotary and vertical kilns; 6 use rotaries only, and 2 use the vertical kilns. The Diamond Portland Cement Company, at Middle Branch, Ohio, shut down its mills for about thirty days, during which time a natural gas equipment was installed. Although the production of Portland cement in this State was larger than that of the previous year by more than 150,000 barrels, yet, by reason of the increase in the total production of the United States, the percentage of Ohio to the whole was lower than in previous years.

Michigan had 10 plants making Portland cement in 1901, and gave a largely increased production. There are 11 new plants already built which will be producers in 1902, and several more are projected. Only 1 company is reported as having abandoned the enterprise in this State, and none were idle for any great length of time. The use of rotary kilns in this locality seems to be general, only 1 company having used vertical kilns last year. This company has now installed rotary kilns, and expects to see appreciable results in its output for next year; its 1901 production was, however, a large one. The new plants reporting are invariably installing rotary kilns.

The other sections mentioned in the above table include California, Colorado, Illinois, Indiana, Kansas, South Dakota, Texas, and Utah, Virginia being tabulated with Ohio.

IMPORTS.

The table showing the imports of cement into the United States by countries is as follows:

Imports of cement into the United States in 1897, 1898, 1899, 1900, and 1901, by countries.

Country.	1897.	1898.	1899.	1900.	1901.
	Barrels.	*Barrels.*	*Barrels.*	*Barrels.*	*Barrels.*
United Kingdom	344, 336	241, 198	199, 633	267, 921	37, 390
Belgium	529, 686	651, 204	624, 149	826, 289	303, 180
France	19, 319	17, 294	15, 649	32, 710	11, 771
Germany	1, 109, 280	1, 032, 429	1, 193, 822	1, 155, 550	555, 038
Other European countries	46, 916	51, 582	68, 348	75, 827	19, 077
British North America	4, 907	4, 635	4, 398	4, 517	6, 066
Other countries	36, 480	15, 476	2, 389	23, 869	6, 808
Total	2, 090, 924	2, 013, 818	2, 108, 388	2, 386, 683	939, 330

The number of barrels used as a base for ascertaining the consumption of cement in the United States in 1901, however, is 922,426, the difference in the figures being due to the fact that a part of the cement brought into the country was immediately exported, and was not, therefore, consumed in the United States, and a part of it was left unused in the warehouse.

The imports of cement for 1901 fell very far short of those of any other year. Such a falling off was anticipated, however, as shown in the report of the Survey for 1900, wherein is set forth the fact that American Portland of an equally high grade as the imported Portland is sold in this country at a greatly reduced price, together with further reasons why the American product should supersede the foreign.

RELATION OF DOMESTIC PRODUCTION TO IMPORTATION.

The following table shows the relation of production to importation in 1891, 1896, 1899, 1900, and 1901. The increase in the percentage of the total consumption of Portland cement produced in the United States is worthy of note. In 1891 it was 13.2 per cent, in 1900 it was 79.1 per cent, and in 1901 it was 96.2 per cent.

Comparison of the domestic production of Portland cement with the imports.

	1891.	1896.	1899.	1900.	1901.
	Barrels.	*Barrels.*	*Barrels.*	*Barrels.*	*Barrels.*
Production in the United States	454,813	1,543,023	5,652,266	8,482,020	12,711,225
Imports	2,988,313	2,989,597	2,108,388	2,386,683	922,426
Total	3,443,126	4,532,620	7,760,654	10,868,703	13,633,651
Exports	....	85,486	110,272	139,939	417,625
Total consumption	3,443,126	4,447,134	7,650,382	10,728,764	13,216,026
Percentage of total consumption produced in the United States	13.2	34.7	73.9	79.1	96.2

The production and annual percentage of increase in the last twelve years have been as follows:

Production of Portland cement, with increases each year, since 1890.

Year.	Product.	Increase.	Percentage of increase.	Year.	Product.	Increase.	Percentage of increase.
	Barrels.	*Barrels.*			*Barrels.*	*Barrels.*	
1890	335,500	....	....	1896	1,543,023	552,699	55.8
1891	454,813	119,313	35.6	1897	2,677,775	1,134,752	73.5
1892	547,440	92,627	20.4	1898	3,692,284	1,014,509	37.9
1893	590,652	43,212	7.9	1899	5,652,266	1,959,982	53.1
1894	798,757	208,105	35.2	1900	8,482,020	2,829,754	50.1
1895	990,324	191,567	24.0	1901	12,711,225	4,229,205	50.0

The total consumption of all kinds of cement in the United States for 1901 was 20,573,538 barrels.

The total production was 20,068,737 barrels, valued at $15,786,789.

NATURAL-ROCK CEMENT.

PRODUCTION.

During the calendar year which ended December 31, 1901, the United States produced 7,084,823 barrels of natural-rock cement, valued at $3,056,278, a continuation of the decrease in production and value observed since 1899.

The output was somewhat smaller than usual in the Rosendale district, New York, owing to the fact that a number of plants were idle part of the year while repairs and alterations, such as enlarging, remodeling, and installing new kilns, were being made. Following is the table showing amount and value of the natural-rock cement produced in the United States in 1899, 1900, and 1901:

Production of rock cement for 1899, 1900, and 1901.

State.	1899.			1900.		
	Number of works.	Quantity.	Value.	Number of works.	Quantity.	Value.
		Barrels.			*Barrels.*	
Georgia	1	13,000	$9,750	1	28,000	$21,000
Illinois	3	537,094	187,983	3	369,276	129,446
Indiana and Kentucky	19	2,922,453	1,022,858	19	2,750,000	687,500
Kansas	2	150,000	60,000	2	146,000	58,400
Maryland	4	362,000	144,800	4	335,070	134,028
Minnesota	2	113,986	56,793	2	109,403	54,701
Nebraska	....	....	....	1	500	400
New York	17	4,689,167	2,813,500	17	3,409,085	2,045,451
Ohio	3	34,557	17,279	3	35,029	17,514
Pennsylvania	5	511,404	255,702	5	687,838	343,919
Tennessee	1	10,000	8,000	1	10,000	8,000
Texas	1	12,000	20,400	1	17,000	28,900
Virginia	3	63,500	38,100	3	25,313	15,187
West Virginia	1	52,727	21,090	1	....	....
Wisconsin	1	396,291	158,516	1	461,005	184,402
Total	63	9,868,179	4,814,771	64	8,383,519	3,728,848

State.	1901.		
	Number of works.	Quantity.	Value.
		Barrels.	
Georgia	2	50,577	$40,967
Illinois	2	469,842	187,936
Indiana and Kentucky	15	2,150,000	752,500
Kansas	[a] 2	175,560	97,002
Maryland	4	351,329	175,665
Minnesota	[b] 2	126,000	63,000
Nebraska	1	....	....
New York	[c] 18	2,234,131	1,117,066
Ohio	[d] 1	104,000	62,400
Pennsylvania	7	942,364	376,954
Tennessee	....	....	....
Texas	1	....	....
Virginia	1	....	....
West Virginia	1	....	....
Wisconsin	2	481,020	182,788
Total	[e] 60	7,084,823	3,056,278

[a] Includes product of Nebraska and Texas.

[b] Includes product of North Dakota.

[c] The number of companies producing natural cement only, is given, and the numbers given for 1899 and 1900 have been changed accordingly, as in those years, heretofore, the *total* number of companies in the State was given.

[d] Includes product of Virginia and West Virginia.

[e] This total includes one plant in North Dakota, which for this year is reported as having a natural cement product.

POZZUOLANA, OR SLAG CEMENT.

PRODUCTION.

Two companies in Alabama, 1 in Illinois, 1 in Maryland, and 1 in Ohio reported products of pozzuolana, or slag cement, for 1901. The entire output amounted to 272,689 barrels, valued at $198,151, as compared with 365,611 barrels, valued at $274,208, in 1900.

Owing to the fact that in each of the States producing this cement, Alabama excepted, there is only one plant, it is impossible to give a detailed statement of amounts and values without disclosing individual figures.

The output in Alabama was doubtless smaller than it will be next year, though it was largely in advance of the product for 1900. One plant was idle during part of the year, and it was impossible to run the other one on full time because of the installation of new machinery and of other extensive improvements. This plant is to have a Portland cement department, with all the necessary machinery, including rotary kilns, in 1902. The chemical analyses of its two brands of cement, "Alabama" and "Magnolia," run as follows:

Analyses of slag cement from North Birmingham, Ala.

	Alabama.	Magnolia.
	Per cent.	*Per cent.*
Alumina	13.20	15.00
Lime	52.00	47.00
Silica	30.00	32.00
Magnesia	1.25	2.00
Sulphur	1.00	1.00
Iron oxide	0.75	1.00
Combined water	1.80	2.00
Total	100.00	100.00

These analyses show that the products contain sulphur and iron in so small a degree that the danger of oxidation is entirely removed, and the cements are safe for use either above or below the surface of water.

In Illinois the firm manufacturing both slag cement and Portland cement in 1901 produced a nearly equal quantity of each, though the Portland cement was somewhat in excess.

In Maryland the company producing slag cement is engaged in its production only, not attempting to produce any other kind of cement. The plant was idle for about four months during the year.

In 1900 there was a production of slag cement by one company in New Jersey, but in 1901 this company reported a large production of Portland cement and none of slag.

In Ohio the company producing slag cement reported a product which shows an increase over their 1900 output.

CONSUMPTION.

Following is a table showing the consumption of all kinds of cement in the United States up to January 1, 1902:

Total consumption of all kinds of cement in the United States to January 1, 1902.

	Barrels.
Natural-rock cement	194, 057, 940
Imported Portland	36, 671, 844
Domestic Portland	40, 030, 598
Total	270, 760, 382

Percentage of each kind.

Natural-rock cement	71. 67
Imported Portland	13. 54
Domestic Portland	14. 79
Total	100. 00

PRODUCTION OF CEMENT IN CANADA.

The product of cement in Canada in 1901 was: Natural-rock cement, 133,328 barrels, valued at $94.415, and Portland cement, 297,066 barrels, valued at $535,615.

PRECIOUS STONES.

By George F. Kunz.

INTRODUCTION.

The chief points of interest concerning precious stones in the United States during the year 1901 are:

(1) The finding of a diamond in Lee County, Ga., which adds a new locality to those previously known; (2) the increased yield of sapphires in Fergus County, Mont., where two companies are now engaged, and further exploration for the fancy-colored sapphires at Rock Creek, Granite County, in the same State; (3) an extensive output of rhodolite garnets in the Cowee Valley, Macon County, N. C., and also considerable mining in other parts of that State for blue, green, and yellow beryls, amethyst, and the new emerald-matrix; (4) continued activity in the remarkable locality for colored tourmalines at Mesa Grande, San Diego County, Cal., and the discovery of a new deposit adjacent to the first; (5) further work at several chrysoprase localities near Visalia, Cal., and the purchase or control of them secured by a company; (6) sustained and enlarged production of turquoises, chiefly in New Mexico, where several important companies are actively engaged in mining them, and the discovery of new turquoise localities in Colorado and Nevada; (7) the finding of epidote crystals, magnificent in size and color, at Prince of Wales Island, Alaska; (8) and the discovery of a beautiful jade-like compact idocrase in Siskiyou County, Cal.

The importation of precious stones for the year 1901 at the port of New York amounted to about $22,500,000. The importation of diamonds has exceeded that of any previous year, and never have larger or finer stones been brought into the United States. Emeralds have greatly increased in public favor; and coral, long out of fashion, has once more become popular.

Although turquoise is now mined by six different companies, and they all have had fair yields, the popularity of the stone has been such that the entire product was consumed.

The first year of the new century has been the greatest in the history of the precious-stone industry in the United States.

Never has the prosperity and growth of a country been more faithfully indicated, as if by a sensitive barometer, than by the wonderful increase in values and business in the jewelry trade in the United States during the past year. Never were more diamonds, pearls, or emeralds sold, nor did fine gems ever before command better prices, nor were they ever more firmly held; and yet diamonds are likely to advance still further during the present year.

Not since the famous looting of the Chinese Summer Palace in 1862 have so many treasures of jade, rock-crystal, pearls, and other precious-stone objects reached not only this country but every country in Europe. The distressing fact remains that many objects, such as an altar set, or a writing set, or the funeral offering at the tomb of an emperor, an empress, or a noble, and made up of two or three pieces, were divided among several soldiers. Often a superb scepter, or some similar object, will have upon its upper side a thick coating of dirt, the firmly knit dust of ages, and the lower side will be as clean as it was when laid upon the tomb a century or more ago. No class of objects, whether the seal of the imperial post-office, or the tomb ornaments of generations ago, or the name of an emperor in jade, escaped the rapacity of the soldiers, who would secrete them in their baggage with other hard stones, or with metal objects, and then carry them in this crude manner halfway round the globe, thus breaking, scratching, and nicking objects of priceless and historic value. Never has the more open boast of "loot" been made within the memory of man. Frequently the objects offered for sale have a complete history, as having been the jade tablets of some famous altar.

Thus three times has China been sacked of its priceless, precious Yu jade objects—at the looting of the Summer Palace, again during the Japan-China war, and finally in the late international war with China; so that to-day New York, Berlin, London, and Paris hold more such objects than any Chinese city.

DIAMOND.

UNITED STATES.

The only authentic instance of the finding of diamonds in the United States during the year 1901 is that in Lee County, Ga. There are reports that several were found along the moraine line near Martinsville, Ind., but these rumors have not yet been verified. Great excitement concerning the supposed discovery of diamonds prevailed for a short time in Montana, but the supposed diamonds proved to be only quartz.

GEORGIA.

Reports have been made on several occasions in the past as to the finding of diamonds in Georgia, but these rumors have lacked full confirmation. A reference to this subject was made in the volume of Mineral Resources for 1900. The repeated occurrences in North Carolina, however, and the similarity of conditions in upper Georgia, would afford grounds for expecting occasional diamond finds in the latter region. In November last a peculiar looking little stone was noticed and picked up by a lad on his father's plantation in Lee County, a few miles from Columbus, Ga. When this was shown to a jeweler in that city he advised its being sent to Messrs. Tiffany & Co., of New York, as perhaps valuable. This course was taken, and the stone was pronounced a diamond and of good quality. The stone was a flattened hexoctahedron of $3.5\frac{1}{16}$ carats; it measured 10 by 8 by 6 mm., and was white, with a tint of green. The owner was Mr. B. F. Hudson, of Columbus, Ga.

MONTANA.

Toward the close of the year one or two prospectors in the northeastern part of Fergus County, Mont., found a number of bright, white pebbles which they supposed to be diamonds. When these facts became known a furore began, and for a short time the excitement ran high over the diamond field in Montana, as it was claimed to be. Reports were widely circulated that New York experts had pronounced the stones to be genuine diamonds of fine quality. Prominent public men became interested, and capital was ready to enter into operations at once if the rumors proved true. The stones were soon found not to be diamonds, and it was then asserted that they must be white sapphires; but the fact was finally recognized that they were rolled crystals of dodecahedral (bipyramidal) quartz. In a few weeks the Montana diamond-field excitement had taken its place with the other similar furores that have from time to time excited the mining world for a brief period.

SOUTH AFRICA.

De Beers Consolidated Mines.—Considerable space was given in the last report of this division to the diamond mines of South Africa and the effects produced upon them by the war in reducing and partly suspending their operation during the year 1900. The succeeding year has witnessed a resumption of activity, which had, indeed, begun before; and the reports of the directors and of the general manager, presented at the annual meeting of the De Beers Consolidated Mines, December 23, 1901, show very marked advances. There have still, however, been many difficulties and limitations consequent upon the continued war. The natives have become so unsettled that the necessary labor is procured only with great trouble and with constant irregularity and uncertainty. The Government has required so much use of the railway line to Cape Town that the De Beers Company has been restricted in the transport of supplies, and has had to limit operations correspondingly; and further, the Government has also made such heavy demands on the African coal produced at the Indwe mines that the company has been forced to import English coal in large quantity at greatly increased cost.

On the other hand, the amount of work actually done was a great advance on the year before, the yield of diamonds having doubled, and the proceeds having more than doubled, owing to a continued rise in price. The company has again paid the usual dividend of 40 per cent, omitted in 1900, amounting to £1,579,582; and a balance of £2,887,999 is carried over. During the year the company bought out for £12,000 the last remaining private claims upon the Du Toits pan mine, and proposes soon to operate that mine on an extensive scale. A new contract has been made with the Diamond Syndicate for the sale of the total output at an increased price, and the De Beers Company becomes a partner with the syndicate to share in any profit. Another important change has been effected in that the three "life governors," Messrs. Cecil Rhodes, Alfred Beit, and Julius Wernher, who have heretofore received a fixed share in the company's profits, have commuted that interest and now receive in its place 160,000 shares of deferred stock, par value £2 10s. each, this amount being equally shared between them. The stock of the company is divided into preferred and deferred stock. The previous arrangement gave the life governors, together, one-fourth of all the profits, after 36 per cent had been paid in dividends on the preferred stock. The new agreement obviates various possibilities of complication, and is regarded as a gain to the shareholders in general and a concession on the part of the governors. Mr. Rhodes personally did not favor it, but yielded to the views and wishes of his associates. The life governors are a self-perpetuating body, and upon the death of any one of them his place must be filled by the choice of his colleagues. A large part of the report is taken up with detailed explanations of this new arrangement, its motives, objects, and anticipated results.

Preparations for more extended and more economical working of the mines are being carried on vigorously. The acting general manager, Mr. Alpheus F. Williams, goes largely into these matters in his report. A great deal of new and improved machinery is being installed, which will substitute automatic processes for much of the native labor, now difficult to procure and to regulate. Steam shovels, mechanical haulage lines between floors and crushing mills, devices for tipping and righting trucks, etc., are described among these improvements. The cold-storage plants at Cape Town and Kimberley, referred to in the last year's report, have proved highly successful and profitable; the dynamite factory is progressing, though it has been delayed by the continuance of the war.

Bultfontein mine.—Operations have begun at the Bultfontein mine, 148,086 loads having been hauled therefrom; but as they had not yet been washed, that number of loads remained on the floor at the close of the year. Of this, 2,443 loads were "yellow ground." A great deal of development has been done down to 600 feet, and the "blue ground" in sight is estimated at 13,000,000 loads.

Premier mine.—The Premier mine, heretofore a shallow, open mine, though of large area, has been developed to a depth of 500 feet. It is now operated on five levels—at 125, 185, and 240 feet as open workings, and at 460 and 500 feet underground, while the main shaft has been sunk 63 feet deeper. The amount of blue ground in sight was estimated at 12,850,000 loads. Much development has also been done here.

The figures of production, as compared with the three previous years in which this mine has been worked, are as follows:

Premier mine production from 1898 to 1901, inclusive.

Year ending June 30—	Carats obtained per load.	Price realized per carat.	Amount realized per load.	Cost of production per load.
	Number.	*s. d.*	*s. d.*	*s. d.*
1898	0.27	20 9.3	5 8.2	2 7.1
1899	.30	22 10.1	6 9.8	2 3.3
1900	.30	25 0.2	7 5.9	2 7.5
1901	.295	27 3.7	8 0.6	3 9.9

The actual number of loads and the yield of diamonds therefrom for the same period were:

Premier mine operations from 1898 to 1901, inclusive.

Year ending June 30—	Loads hauled.	Loads washed.	Loads remaining on floors.	Carats of diamonds found.
1898	1,146,984	691,722	727,039	189,356
1899	2,032,771	1,662,778	1,097,032	496,762
1900	980,210	736,929	1,340,313	220,762
1901	1,571,631	1,517,981	1,393,963	447,399

The total value of these diamonds was £610,831 4s. 10d., a much greater result than that of any previous year's production from the Premier.

The two great mines, the De Beers and the Kimberley, are for the most part treated together in the reports of the company. The figures for the last year, as given below, in comparison with those of the three years preceding, show a great recovery from the setback produced by the war.

De Beers and Kimberley production from 1898 to 1901, inclusive.

Year ending June 30—	Carats obtained per load.	Price realized per carat.		Amount realized per load.		Cost of production per load.	
	Number.	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*
1898	0.80	26	6.2	21	2.1	6	7.4
1899	.71	29	7.2	20	11.5	6	7.7
1900	.67	35	10.2	23	6.9	7	6.2
1901	.76	39	7.0	30	3.1	8	5.0

It will be seen from these data that the yield per load has not only recovered from the diminution referred to in the report of this division for last year,[a] but has improved, and that the price of diamonds has continued to rise, being now higher than ever before in the history of these mines, and just about double what it was in 1889, previous to their consolidation. The increased cost of production, both in these mines and in the Premier, is due to the various unfavorable conditions above noted as results of the war, and to large amounts of development work.

Taking the actual amounts of production and comparing them in like manner, the figures are as follows:

De Beers and Kimberley operations from 1898 to 1901, inclusive.

[Fractions of carats and of pounds are omitted.]

Year ending June 30—	Loads hauled.	Loads washed.	Loads remaining on floors	Carats of diamonds found.	Amount realized thereon.
1898	3,332,688	3,259,692	2,377,913	2,603,250	£3,451,214
1899	3,504,899	3,311,773	2,937,784	2,345,466	3,471,060
1900	1,673,664	1,522,108	2,722,595	1,000,964	1,794,222
1901	2,120,397	2,616,873	2,216,119	2,000,495	3,959,383

The market value of the year's output is the largest in the history of the company's working, owing to the fact before noted, that the price per carat has been higher than in any previous year. With the opening of the Bultfontein and other mines now controlled by this company, and the improved machinery and appliances constantly introduced, the yield of diamonds would seem certain to be further enlarged. It becomes a curious question whether the price can still continue to advance and the demand for an article of such pure luxury keep pace with the supply. This has been the condition thus far, and of course the company can at any time limit the output in the event of either actual or anticipated fall in price. But with the present general prosperity this seems very remote.

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[a] Mineral Resources U. S. 1900, p. 751.

GUIANA.

The diamond mines on the Upper Mazaruni River, in British Guiana, were described at some length in the last report.[a] The United States consul at Demerara, Mr. George H. Moulton, has again given an account of these workings, under date of January 28, 1902.[b] He states that the prospects are favorable and the local excitement great, only the difficulty and expense of reaching the district with proper facilities for working preventing a rush of explorers. Up to the date of his account the total of diamonds exported was valued at the custom-house at $50,000. Parties from New York had located claims and kept men at work, and in six weeks they obtained 8,227 small diamonds, weighing about 767 carats and valued at $9,600. This is about $12.50 a carat, much the same as the London valuation reported last year.

Mr. Moulton states that there are now a dozen companies organized and new expeditions constantly starting for work. Although no data are given as to the area of diamond-bearing ground, it is clear from these facts that the prediction as to a large increase in the extent of the recognized deposits, made by the Government explorers, Messrs. Harrison and Perkins, and referred to in the last report (p. 752), has been already verified. The great obstacle to free and rapid development is the long journey in small boats from Bartica to the mines, and the necessity of carrying, from the final landing for several miles to the workings, everything on the heads of native laborers. Mr. Moulton suggests the advantage and the profitableness of a steam or electric railway along the Mazaruni Valley as offering a favorable opening for capital. The project has already been broached, and it would be warmly welcomed in the colony

BORNEO.

The first extended account of the diamond-producing district of Borneo that has been accessible to the general scientific world has been published in the Annales des Mines for 1901, by M. Gascuel, a mining engineer.[c] This is not, indeed, a full account of the Bornean diamond beds, as it deals only with one of the most important of several regions; but it possesses very considerable interest, and adds much to our previous imperfect knowledge.

Diamond-bearing deposits have been known and worked for centuries by the Malays, at both the eastern and the western extremities of the northern coast of the island. The latter region is that around

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[a] Mineral Resources U. S. 1900, pp. 752–753.

[b] U. S. Consular Reports, No. 1275.

[c] Les gisements diamantifères de la région sud-est de l'ile de Bornéo (possessions hollandaises); par M. Gascuel, Ingénieur civil des Mines): Annales des Mines, Mémoires, tome XX, neuvième série, Paris, 1901.

Landak, not far from Pontianak, the capital of the western district. The former is near Banjermassin, on the Martapoera River.

CORUNDUM GEMS.

SAPPHIRE.

MONTANA.

Montana is now becoming famous as a region productive of sapphires, not only those gathered from the bars of the Upper Missouri for some years past, but recently and particularly the gems that are mined from the rock in Fergus County, in the now celebrated Yogo district. The rock in which sapphires occur at this point is a basic igneous outflow, the upper portion of which has been eroded away and only the dike left. This dike, nearly vertical, is seen cutting the country rock, which is a hard gray limestone above, underlain by a softer shale. The latter is visible only at the eastern end of the line of workings, where the country falls off to a small basin on the eastern slope of the Little Belt Mountains nearly to the level of the valley of Judith River. This point is about 2 miles north of the river and 10 miles west of the town of Utica. From this eastern end the dike extends to the summit of Yogo Hill, 3 miles west, and thence 2 miles farther, across and beyond Yogo Creek, a total exposure of about 5 miles, its course marked all the way by a line of shafts, drifts, and open cuts.

Two companies are engaged in working this dike or "vein," as it is frequently though not correctly called—the New Mine Sapphire Syndicate, from the eastern extremity to the crest of Yogo Hill, and the American Gem Mining Company, from that point to and across Yogo Creek. All the work of the latter company is done by blasting; that of the former is partly by the hydraulic process. The methods employed are a curious combination of those of the California gold-workings and the South African diamond mines. As in the latter, the gangue of the gems is an igneous rock, hard below, but decomposed above, in varying degrees, to a mere earthy mass at the surface. From this last the gems are separated by washing and sluicing, much in the manner of placer gold; though because of the less density of sapphires more care is necessary, and the sluice boxes must be less inclined, to prevent the gems from being carried over the riffles. Most of the New Mine Syndicate's workings are surface openings and cuts, some of the latter very extensive. Water is carried from Yogo Creek, 10 miles distant, by a ditch and flume, with a parallel hydraulic pipe line, and a system of sluices extends all along the company's workings.

Where the rock is much decomposed the hydraulic process is employed largely; as it becomes harder, powder is necessary to break it up. Then the rock is thrown out in dumps and allowed to disintegrate by exposure to the weather, as with the African "hard blue." This process requires from a month to a year, according to the condition of the material. Sometimes a stream of water is turned on the dumped rock, and the process thus expedited. When sufficiently decomposed, this material is subjected to the same washing process as the material naturally disintegrated.

Some of the open cuts along the dike are very large. One is 700 feet long and 90 feet deep; another, called the "Blue Diamond cut," is 1,200 feet long and 50 feet deep at its greatest depth. The side of this latter cutting gives a very fine section of the dike, showing the entire gradation from the hard rock below to the soft surface condition. The former is bluish or gray, while the latter becomes brown, reddish, and yellowish, from oxidation of the contained iron. The decomposition has extended to varying depths, in some cases to as much as 50 feet from the surface.

At some points tunnels have been driven several hundred feet into the hard rock, by both of the companies. The dike is fairly uniform in width, and maintains about the same richness in sapphires throughout. In the shale beneath the limestone at the eastern end the rock is somewhat different in character from that elsewhere, more basalt-like than in the limestone.

In the washing the fine earth is carried away with the water, all hard lumps remaining are again thrown out on a dump to decompose further, and the sapphires, after several screenings, are picked out by hand. All are saved, the larger for gems and the smaller for watch jewels, etc. The minute and imperfect ones are crushed and used for polishing powder, sometimes mixed with diamond dust in cutting the larger stones. The Yogo sapphires vary from very small ones up to gems of 4 or 5 carats in their natural state, though a few have been found of larger size—one of 8 carats in the American Gem Company's portion (in the Fourth of July claim), and one of 9 carats in the Syndicate's portion. The latter company sends its product to London for cutting, the former to Helena.

CORUNDUM.

UNITED STATES.

A very important publication appeared during the past year in the extended paper of Dr. Joseph Hyde Pratt, State mineralogist of North Carolina, on The Occurrence and Distribution of Corundum in the United States.[a] In this pamphlet are brought together and systematically treated all the recent discoveries and studies upon the origin and the distribution of corundum in all its forms at all North American localities. Many of these have already been referred to by the writer in reports of this survey.

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[a] Bull. U. S. Geol. Survey No. 180, 1901, p. 98.

For the last twenty years the fact has been gradually coming into recognition that corundum, formerly regarded as rare, is in reality much less so than was supposed, and that it has been developed in many kinds of rocks and under highly varied conditions. Dr. Pratt discusses the three varieties, as determined by their uses—gem material, corundum proper, and emery—and treats of the localities of each kind in full.

The gem varieties exemplify well some of the differences in the character of the containing rocks just now alluded to. The Montana sapphires, in two of the chief localities—the bars of the Missouri and the more recent mines at Yogo Gulch—have been traced to their source in igneous dikes. In the latter the rock is termed by Dr. Pratt "a basic minette," an intimate mixture of biotite and pyroxene; in the former it is a mica-augite andesite, apparently altered from an augite-mica syenite. The true rubies of Cowee Valley, Macon County, N. C., have not been fully traced to their parent rock, but the indications are that this is probably an amphibolite or eclogite. The rock underlying the gravels in which they occur is both greatly decomposed and greatly disturbed, but rocks of the types above named are found in and beneath the decomposed portion, and outcrops of similar material occur in the vicinity, which contain corundum, though not the ruby crystals.

The first third of the bulletin discusses the very varied modes of occurrence of corundum in general; the middle third describes the distribution, by important localities, of (1) gems, (2) corundum, and (3) emery; the concluding portion deals with methods of mining, uses, and manufacturing processes, and contains an almost complete list of American localities. The paper is illustrated with numerous views and plates. It forms a most complete and valuable monograph on a subject of both practical and scientific importance, and it is remarkable that this, as well as the classic paper upon corundum by the late Prof. F. A. Genth,[a] were both published by members of the staff of the North Carolina geological survey. It is not mentioned, however, that the supposed first recognized locality of corundum in the United States in reality is Anderson, Laurens County, S. C., where it was noted by John Dickson in 1819.[b]

MONTANA.

In my last report[c] mention was made of large quantities of corundum, besides the sapphires, found in the Yogo district and lying on the dumps unused until transportation facilities should improve. It seems that Montana corundum is now beginning to attract attention, and may prove important commercially. Thus far the only point where systematic exploration for it is in progress is in the south-central part of Gallatin County, near the headwaters of Elk Creek, among the foothills between Gallatin Valley and Spanish Creek Basin.

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[a] Corundum, its Alterations and Associated Minerals; Philadelphia, 1873.

[b] Gems and Precious Stones of North America, 1892, p. 42.

[c] Mineral Resources U. S. 1900, p. 756.

Corundum was first found here some years ago by Mr. Harris Kirk, who owned a considerable area of ranch land in these hills, and when it was recognized several claims were located. Only of late, however, has any definite prospecting or surveying been done. The vein has been traced for 2 miles along a ridge south of Elk Creek, and some thirty trial pits have been sunk. The rock is gneiss, principally, and the corundum-bearing veins appear to be conformable to it and in close parallel association with bands of quartz, separated by garnetiferous and hornblendic schist. The general mode of occurrence recalls that of the corundum bands in gneiss described by Professor Pratt from two localities in North Carolina and noted in my last report,[a] though to which of his two types of gneiss occurrence that in Montana belongs can not yet be determined. The main vein consists of a white, friable feldspar, with walls and margins of vermiculite, which sometimes increases in proportion until it forms a large part of the vein. Through these minerals the corundum is disseminated in crystals and crystalline grains, varying from a small fraction of an inch to 8 or 10 inches in length, often as beautiful elongated hexagons, and forming from 15 to 75 per cent of the vein mass. The seam averages about 28 inches in thickness along the outcrop, sometimes more, and has been traced downward to half the depth of a canyon formed by Elk Creek cutting through the ridge. This canyon is 800 feet deep, but the lower half is so obscured by a talus of fallen rocks that the vein could not be reached or seen. It appears, however, to dip regularly northward with the surrounding gneiss.

The corundum is found upon trial to be of good quality for vitrifying and to make excellent wheels by the silicate process. A number of claims have been staked out, and a company has been organized. Mr. Leverett S. Ropes has paid much attention to the exploration and development of this mineral.

CANADA.

ONTARIO.

Operations have begun regularly in the Ontario corundum region, described in the report of this division for 1898.[b] The Canada Corundum Company, Limited, of Toronto, with a branch office at Bridgeport, Conn., has erected works and started operations on the Robillard property, in Renfrew district, township of Raglan, 7 miles south of

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[a] Mineral Resources U. S. 1900, p. 756.

[b] Twentieth Ann. Rept. U. S. Geol. Survey, Part VI, 1899.

Combermere. As the corundum-bearing rock forms a large outcrop over a high hill, abundant material is in sight for years to come by simple quarrying, with no under-ground work. The rock averages from 12 to 15 per cent of corundum, and it is found that the best material is produced when the mineral occurs well disseminated in rather small crystals; hence that portion of the deposit which presents this character is being principally exploited at present. The works are already supplied with varied machinery of modern type—crushers, jigs, concentrators, etc.—with a capacity of 20 tons a day; but more machinery is being added which will have double the capacity of that already installed, together with a magnetic separator for magnetite. Water power is the operating force. The present plant is, however, only experimental, and more extensive works are in contemplation. About 45 men are now employed. A road is under construction to a landing on York River, 3 miles from the mine and 4 miles from Combermere.

At the end of 1900 about 60 tons of sized corundum had been produced here, and a large number of wheels manufactured therefrom. These are reported by all who have used them to be of the highest quality for abrasive work.

Other companies are being organized to develop other portions of the Ontario corundum field. Among these, the Crown Corundum Company, Limited, will work the Methuen and Burleigh deposits, in Peterboro district. Like the Canada Company, above noted, this one also combines American and Canadian capital, its president being in Boston and its secretary in Toronto.

Large exhibits of the corundum-bearing rock from this region were shown in the Canadian section of the Mining Building at the Pan-American Exposition at Buffalo.

CORUNDUM AND ELÆOLITE-SYENITES IN INDIA.

Mr. Thomas H. Holland[a] has described the occurrence of elæolite-syenites in close association with corundum-bearing syenites in the Coimbatore district of Madras Presidency. These rocks, occurring together as they do, present a remarkable similarity to those of the corundum region in Ontario, Canada, described in the report of this Survey for 1898.[b] The elæolite-syenite appears in several varieties; it is gneissoid in character, conformable to the surrounding and inclosing gneisses. A remarkable feature is the presence of graphite in the rock mass and also in bands and lenses. Mr. Holland, in view of this feature, has sought carefully to determine the origin of the elæolite rock, whether igneous, as has been generally held, or otherwise; but he finds no absolute evidence, though inclining to the former view and regarding the foliation as imposed before full consolidation. If this be true, it presents the novel and important feature of the occurrence of graphite in a properly igneous rock—a fact which, as Prof. L. V. Pirsson remarks, may be correlated with the occurrence of carbon in meteorites and of diamonds in the South African peridotite, and may lead to important conclusions tending to the solution of vexed problems in geology. The corundum appears in a highly feldspathic syenite associated with the elæolite rock, sometimes containing red garnet and sometimes chrysoberyl. The relations of the two syenites were not clear, but Mr. Holland regards them as differentiated products from the same magma.

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[a] Memoirs Geol. Survey India, Vol. XXX, Pt. III, 1901, pp. 169-220.

[b] Twentieth Ann. Rept. U. S. Geol. Survey, Pt. VI, 1899, pp. 18-21.

RUBY.

NORTH CAROLINA.

Ruby matrix.—The well-known occurrence of pink and red ruby corundum in a green amphibole (smaragdite), at Buck Creek, Clay County, N. C., has been utilized for a new semiprecious stone. Pieces are selected in which the bright spots of red or pink ruby are inclosed in the bright-green matrix. The contrast is very pleasing, and the stone is being introduced under the name of ruby matrix and adds one more material of this kind to the opal matrix, turquoise matrix, and emerald matrix, which have become so popular of late.

BURMA.

The Burma Ruby Mines Company, Limited, of which an account was given in the last report of this division,[a] has again made a successful showing, after a number of years of difficulty now apparently past. The first favorable results, announced last year, have been exceeded in the year ending February 28, 1902, as shown by the report of the directors' annual meeting in June. A dividend of 17½ per cent was declared (as against 12½ per cent in 1900), amounting to £26,162 10s., leaving a net balance to be carried over of £10,123 17s., as against £8,881 5s. in 1900.

The amount of gemmiferous earth ("byon") washed and the cost involved for the two years are stated as follows:

Operations at the Burma ruby mines.

Year.	Number of loads.	Cost per load.
		d.
1900	818,135	10.39
1901	947,444	10.29

Comparing these data with those given in the table for the previous seven years (on page 758 of the last report of this division, above cited), it will be seen that the yield continues to increase and the cost to diminish.

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[a] Mineral Resources U. S. 1900, pp. 757-758.

The second electrical pumping plant has proved eminently successful, and a third has been ordered and has arrived, intended for a new mine, on which preparatory work was begun in January, 1902, and which was expected soon to be yielding gems.

EMERALD.

NORWAY.

The old and well-known emerald locality at Arendal, Norway, which has long yielded mineralogical specimens, was taken up for exploitation some two years ago, in the hope of obtaining gems, by the Norwegian and General Exploitation Company, Limited, of London, and an exhibit was made of gems and specimens at the Paris Exposition of 1900. Many cut gems, most of them pale in color, but generally free from flaws, were shown. Up to this time, however, the mines have not been profitably worked, and the second annual report of the company, presented on December 21, 1901, is not very promising. Work had been carried on through the year in a manner deemed entirely capable and satisfactory, but with small results in emeralds, though much fine beryl was procured. The uncertainty of emerald mining is referred to, and the statement made that "first-class stones may be met with at any time." The stock of emeralds on hand is valued at £934 19s. 8d., and the balance of the profit and loss account for the year is £2,110 11s. 6d. The stock of gems appears to have come over from the previous year, when it was valued at £1.127 3s. 9d., the diminution being due to sales made during the year.

This occurrence of emerald strikingly resembles that at the Crab Tree Mountain, Mitchell County, N. C., which latter locality has afforded many of the emerald matrix specimens, and was first described by the writer in these pages.[a]

GOLDEN BERYL.

NORTH CAROLINA.

Dr. J. H. Pratt exhibited, in the North Carolina section of mineral products at the Charleston Exposition, a crystal of golden beryl an inch and a half in diameter and over 2 inches long, taken from an Indian mound near Tesanty Creek, Macon County, N. C. This place, elsewhere referred to in this report as yielding fine amethysts, is not far from the Littlefield beryl mine, and it is supposed that this crystal must have come from that locality. This is the first noted occurrence of a beryl crystal in an Indian grave.

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[a] Sixteenth Ann. Rept U. S. Geol. Survey, Pt. IV, 1895, p. 600.

CHRYSOBERYL.

MANHATTAN ISLAND.

Chrysoberyl is a mineral of such rare occurrence that the recognition of another well-defined American locality for it is of considerable interest, even though the specimens found be very few. The Manhattan gneiss, of which the island on which New York is built is mainly composed, is very rich in the number of mineral species which it has yielded, though few of them are abundant or remarkable for elegance. The late Benjamin B. Chamberlin, an enthusiastic local mineralogist, whose collection was purchased after his death by the New York Mineralogical Club and deposited with the American Museum of Natural History, where it still remains under mutual agreement, published a complete list of the minerals of the island, with bibliographical references to all previous treatment of the subject.[a] In that list, which comprised no less than 76 species and 111 varieties, chrysoberyl is mentioned as having been found by William Niven, near High Bridge, "in small crystals on orthoclase," in May, 1888, and also in the Fort George locality.

During the last year, however, Dr. Wallace G. Levison has published a full account of two very well characterized specimens obtained by him on Manhattan Island, one in 1893 and the other in August last. The first was exhibited at a meeting of the New York Mineralogical Club, November 9, 1894, but was not then publicly noticed. A full description, with enlarged half-tone plate, was published in a pamphlet by Dr. Levison, dated July 15, 1901, and a crystallographic account of it, with enlarged woodcut, by Dr. A. J. Moses.[b] After the discovery of the second and larger specimen, Dr. Levison prepared a second edition of the pamphlet entitled Crystals of Chrysoberyl from the Borough of Manhattan, New York City, issued under date of October 15, and including the later specimen. The two crystals were not found in the same locality, but about half a mile apart. The first was from Eighty-eighth street and Amsterdam avenue, the second from Ninety-third street and Riverside Park. Both show that they represent several grouped crystals, part of which have been lost. Both are of good color; the second and larger one is a very fine, delicate light green, while the other is more brownish or olive. In crystallization they are not alike, the first being, in the words of Professor Moses, "of the heart-shaped type, with prominent pyramid, described by Kathrein as occurring at the emerald mines of Takowaia, Siberia, and is composed of two individuals with the usual twinning plane P (031). It is not tabular." The dimensions are 8 by 10 by 14 mm. Professor Moses gives a full list of measurements for all the faces. The second specimen is a large tabular crystal, or rather several parts of one, some 8 mm. thick, and the larger portions over 20 mm. in diameter. The striated *a* faces are broad and brilliant; no detailed measurements have been made of the others as yet. Both are in quartz, mingled with oligoclase feldspar. The specimens remain in the possession of the finder, Dr. Levison, of Brooklyn.

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[a] Trans. New York Acad. Sci., 1888.

[b] Am. Jour. Sci., August, 1901 (4th ser., Vol. XII, No. 68, pp. 104–105).

GARNET.

RHODOLITE.

NORTH CAROLINA.

In the report on Mineral Resources for 1898 reference was made at some length to the composition of the peculiar and beautiful gem-garnet from the Cowee Valley in North Carolina, for which the name of rhodolite has been proposed and generally adopted. At that time, as there stated, the mineral had been found only in rolled fragments, not in crystals, and its matrix was unknown. By a recent letter from Mr. W. E. Hidden, who is engaged in working the locality, it appears that these missing data are now to some extent supplied. He reports having found several crystals during the summer of 1901, of considerable size, embedded in a decayed or saprolitic rock, though of what character is not stated. One crystal weighed as much as 3½ pounds (avoirdupois) and yielded 300 carats of fine pale-red material, flawless and suitable for cutting. The crystal was a trapezohedron, and had developed "parting planes" in all directions, but enough remained to yield the amount of gem material above mentioned. Mr. Hidden also reports having found rhodolites inclosing green and yellow crystals of apatite.

The yield for the year was about 200,000 carats, which may be valued approximately at $20,000 after cutting. Mr. Hidden estimates that seven-eighths of the total weight must be lost in shaping and cutting, certainly three-fourths, while many of the pieces found—perhaps one-half—are too small to cut profitably at the present rates.

Very fine exhibits of these rhodolites, in the rough and also cut, were displayed in the North Carolina section of minerals and mining at both the Buffalo and Charleston expositions.

PYROPE.

NEW YORK.

A number of small and brilliant garnets, probably of this species, were obtained last summer from a new opening in the peridotite outcrop at Syracuse, N. Y. They were too much shattered to have any value as gems, but are of much geological interest in adding a further point of resemblance in this rock to that of the African diamond mines and of Isoms Creek, Kentucky. It will be remembered that the late Prof. H. Carvill Lewis emphasized the similarity of the peculiar rock at these three points, and proposed for it the name of kimberlite.[a] The pyrope garnets, or "Cape rubies," of the African mines had their analogue in the pyropes found in the Kentucky rock, but none had before been obtained at Syracuse. Of course the discovery led to some excitement when these facts were made known, and sensational articles appeared, of the usual kind, about rubies and diamonds to be anticipated at great depths in central New York.

TOPAZOLITE.

CALIFORNIA.

According to Mr. Max Braverman, many fine groups of topazolite garnet were taken out during the year from the locality near Visalia, Cal., before referred to in these reports.[b]

SPESSARTITE.

CALIFORNIA.

In addition to the interesting tourmalines, rose beryl, and other material that have been found at Mesa Grande, San Diego County, Cal., may be noted spessartite garnet implanted on a garnet rock in brilliant crystals from 5 to 15 millimeters in diameter, with striated faces. The crystals are usually translucent and would only furnish small transparent gems; but they possess great brilliancy.

GROSSULARITE, WITH EPIDOTE.

ALASKA.

A remarkable discovery has been made during the past year on the property of the Green Monster Copper Mine Company, near Sulzer, Prince of Wales Island, Alaska, of magnificent crystals, large in size and brilliant in color, of epidote and grossularite garnet, associated with twin crystals of quartz of the Japan type. The epidote crystals are implanted on a vein rock of epidote or on crystallized quartz, and are either associated or coated with crystallized quartz. The crystals are generally isolated and distinct, are rather stout in habit, are bright dark green with brilliant luster and pistache-green reflections. This color is more pronounced on the broken and fractured pieces. They are almost invariably twinned, and vary in size from 1 cm. to 15 cm. in length, in one case a single detached crystal weighing 359 grams (10 ounces).

The garnet is true grossularite, and is disseminated throughout the chalcopyrite of the copper mine, in which it occurs in isolated dodecahedrons ("I") with the trapezohedral faces slightly developed. The more brilliant crystals, however, are found in the limestone contact, where they occur with lustrous faces from 3 mm. to 12 mm. in diameter, varying greatly in color—pale cinnamon, pale brown, rich honey brown, dark brown, pale yellow brown, dark brownish green, smoky brown, and greenish black. All these are in the form of crystalline sheets over a paler mass, and are not detached as when found in the chalcopyrite. The paler-colored garnets are all smaller, the darker larger, some of the latter measuring 12 mm. on the face.

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[a] Eighteenth Ann. Rept. U. S. Geol. Survey, Part V (continued), 1897, p. 1191.

[b] Seventeenth Ann. Rept. U. S. Geol. Survey, Part III (continued), 1896, p. 911.

The quartz occurs generally crystallized, associated with, upon, or under the epidote crystals, almost always doubly terminated, transparent, and very often inclosed or coated with green chlorite. Among these are found crossed crystals. In habit the crystals are smaller at one end than at the other. The twin crystals resemble those of Japan, but none measure more than 1 inch in length. They are flat, and generally are coated with chlorite. The chalcopyrite forms a large vein mass, with quartz containing cavities in which are malachite crystals. It also incloses pyrrhotite, as well as the grossularite. The epidote is principally found at a contact with a limestone vein, as is frequently the occurrence. The finer crystals, however, are not found in the vicinity of the main copper mass.

ALMANDITE.

GERMAN EAST AFRICA.

Another remarkable discovery in 1901 was that of garnet in Luisenfeld, German East Africa. The garnet is a variety of almandite with a color inclining to brown. It is brought to commerce in fractured pieces, probably originally large crystals. Some of these pieces measure over 1 inch in length and more than half an inch in thickness. Immense quantities have been found, and it has made its way extensively into the commerce of Europe in sacks weighing 50 or more pounds each. This garnet is largely transparent, and yields handsome gems of a rich brown-red up to 10 carats in weight.

PERIDOT.

UPPER EGYPT.

One remarkable development of the year was the great quantity of peridot, olivine, or chrysolite, as the gem is known, fine examples of which at one time or another have existed among almost all well-known church treasures of Europe. The original locality of these gems is unknown, at least in many cases, and, as the writer has suggested, they must date back to the time of the Crusades, having been brought from the East, and, from time to time, having found their way into commerce from churches and cloisters by changes which time brings about, but which can not be explained except by such processes as those by which the jade and rock crystal objects have reached us from China during the past year.

The new source, which is doubtless the old one rediscovered, is not yet precisely known, or rather made known, but it is somewhere in Upper Egypt, near the Red Sea. Large quantities of the mineral, both in crystals and broken pieces, have been brought to Europe and sold, and some have reached this country. Most of these are small, not over 1 or 2 carats, but very brilliant; some are as large as 20 or 30 carats, but rarely more; a crystal of 90 carats and a mass of 190 carats have also been found. In the earlier times pieces weighing as much as 200 or 300 carats were obtained, such as those to be seen in the Dom Schatz of the Cologne Cathedral, and in the American Museum of Natural History at New York. When the exact locality of the new supply can be reached and scientifically examined the mode of occurrence of such quantities of transparent olivine will be a matter of much interest.

VESUVIANITE (IDOCRASE).

CALIFORNIA.

In California there has been a very interesting discovery of massive green vesuvianite, which seems capable of being used as an ornamental stone. It was found by Dr. A. E. Heighway, on land owned by him on the South Fork of Indian Creek, 12 miles from Happy Camp and 90 miles from Yreka, in Siskiyou County. Here a hard and handsome stone, varying from olive to almost grass green, and taking a fine polish, outcrops for some 200 feet along a hillside about 100 feet above the creek, and large masses have fallen into the bed of the creek below. It was at first supposed to be jade (nephrite), but proves to be vesuvianite. The fallen pieces were in some cases as much as 5 feet square and 2 feet thick, of excellent quality for polishing, and of varying shades of light to dark green. The associated rock is precious serpentine.

The mineral acts very feebly between crossed nicols. Its specific gravity, determined from two pieces, is 3.286. It closely resembles the mineral from the south side of the Piz Longhin, in the Bergellthal, also found in rolled pieces in the bed of the stream called the Ordlegna, near Casaccia, in the Upper Engadine. These were at first taken for jadeite,[a] but were positively identified as idocrase by the analyses of Berwerth.[b] It seems remarkable that the same mistake should have been made in both cases as to this massive idocrase, but its whole aspect is so jade-like that it is not surprising. The rich translucent green color, fine-grained subsplintery fracture, and brilliant luster when polished all strongly suggest jade. The polished surface shows minute pale streaks or flocculi, which still further heighten the resemblance. It is proposed that work be undertaken at once to develop this material, which, if obtained in sufficient quantity, would be an interesting addition to American ornamental stones.

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[a] Fellenberg, Jahrb. Min., Vol. 1, 1889, p. 103.

[b] Ann. Mus. Wien, Vol. IV, 1889, p. 87.

TOURMALINE.

CALIFORNIA.

The remarkable new locality of colored tourmalines at Mesa Grande, San Diego County, Cal., described in my last report[a] has continued to yield exceedingly choice material. It occurs on the same belt as that in which is found the lepidolite of Smith Mountain, and the close association of this lithia mica with the colored lithia tourmalines, familiar elsewhere, leads to a belief that there may prove to be a zone of these valuable and interesting minerals traversing this region. At Mesa Grande the tourmalines occur in a vein of mingled quartz, lepidolite, and feldspar, which is exposed by erosion for a distance of some 300 feet or more on the mountain side. The locality has been known to the Indians, who break up the rock by blasting, and thus get access to the cavities, in which the tourmalines chiefly occur. Many crystals are also found loose in a red clay, resulting from the decomposition of the rock.

The story runs that about twenty-five years ago some Indian children playing around their camp in this vicinity picked up an oddly shaped stone about 3 inches long, six-sided, and as thick as a lead pencil or thicker, which, when cleaned and rubbed, was found to be of a rich blue color, partly clear and very brilliant, like a sapphire. This, although not known or understood at the time by those who saw it, was probably the first tourmaline discovery in San Diego County. Subsequently other crystals were picked up by Indians and cowboys, who prized them for their attractive colors—blue, green, red, etc.—but had no knowledge of their real character or commercial value. Now, as above mentioned, the Indians have learned somewhat how to get them from the rock. The spessartite garnet found at this locality has already been noted under "garnet," above.

E. A. Wulfing, in a recent article,[b] publishes his studies on the optical properties of the Elba and Haddam neck tourmaline, giving a series of comparative optical tables.

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[a] Mineral Resources U. S. 1900, pp. 761-762.

[b] Centralblatt fur Mineralogie und Geologie, 1901, pp. 299-302.

JADEITE.

MEXICO.

Probably one of the most important recent discoveries of jadeite was that made in the excavations of the Escalerillas, immediately back of the cathedral of Mexico, near or upon the site of the great temple. This excavation was carried on during the years 1900 and 1901 and brought to light at least 2,000 beads of jadeite, jadeite tablets, many hundred copper objects, and a large and beautiful obsidian knife measuring 32 inches in length. This Dr. H. M. Saville believes to have been placed there as an offering at the time of the dedication of the temple. A few fine specimens are in the collection of the American Museum of Natural History.

NEPHRITE.

NEW ZEALAND.

Reference was made in the last report[a] to the discovery of nephrite in place in Siberia. A recent announcement of its occurrence in serpentine on D'Urville Island, New Zealand, is made in a paper by E. Dieseldorff, referred to in the American Journal of Science for January, 1902.[b] This is the first discovery of nephrite in place in New Zealand, where it has so long been known and used, but heretofore always from bowlders. The mineral was found here both as nodular masses in serpentine and as bowlders, with the interesting difference that while the latter were essentially true actinolite, with no signs of alteration, the former showed uralitization, being in fact uralite-nephrite. This indication bears out a suggestion made years ago by Arzruni that nephrite may in some cases be an alteration from an original pyroxenic mineral.

MOONSTONE.

NORTH CAROLINA.

A very interesting new form of moonstone has been found by Mr. D. A. Bowman, near Bakersville, N. C. The moonstone is either white or gray feldspar, oligoclase, at times quite transparent, then translucent, being remarkable because, parallel to the cleavage planes, there are crystals of a red goethite that are unusually brilliant and iridescent by reflected light; so that in one position the stone may have the appearance of a moonstone, and in another that of a sunstone.

This moonstone occurs about 1 mile north of Bakersville, at the base of Medlock Mountain, on the land of W. G. Bowman, in a vein of granite and white feldspar in a hard, bluish-glistening schist, steeply inclined, and with a strike of about 15° north of east. The locality was exposed by a slide or washout in a great freshet in May, 1901, but the mineral was not discovered until some months afterwards. The moonstone itself forms a band or "streak," rather narrow at times, but traceable for 200 or 300 yards across the cove in which it appears. Goethite is present also in small amounts in the adjoining bluish schist.

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[a] Mineral Resources U. S. 1900, p. 767.

[b] Am. Jour. Sci., 4th ser., Vol. XIII.

FELDSPAR AS AN ABRASIVE.

Dr. N. H. Winchell reports that efforts have been made at Duluth, Minn., to introduce labradorite as an abrasive material. When ground and properly cemented on a wheel which is revolved with sufficient velocity the application of steel to its surface causes sparks of hot steel to fly in the same way as from a corundum wheel. This labradorite is obtained from the anorthosite masses of Minnesota.

QUARTZ.

ROCK CRYSTAL.

TENNESSEE.

A very interesting occurrence of quartz crystals is reported from near Russellville, Hamblen County, Tenn. They are small but beautiful, and quite as brilliant as those from Herkimer County, N. Y., and interesting as being double pyramids, well developed, with the pyramidal faces elongated. They are found both colorless and smoky, and sometimes present peculiar forms of twinning.

SMOKY QUARTZ.

ALABAMA.

Prof. Eugene A. Smith, of the University of Alabama, reports the discovery of very handsome crystals of smoky quartz in that State, near Zana, Tallapoosa County. Specimens were sent to New York to be tested as to their fitness for ornamental use, and two fine brilliants were cut, which left nothing to be desired in color or brightness. None of this material has yet been placed on the market.

MONTANA.

An immense crystal of smoky quartz weighing 93½ pounds was found in Montana near Clear Creek, Jefferson County, by Mr. O. P. Chisholm, of Boulder, Jefferson County, Mont. It measured 22 inches long and 13 inches wide, and before the fracture it must have been 25 inches long. The prisms of the crystal were quite perfect, but the terminal planes had been broken.

ROSE QUARTZ.

SOUTH DAKOTA AND CALIFORNIA.

The old locality for rose quartz in the Black Hills, in Custer County, S. Dak., is still somewhat worked, and there are immense quantities of the mineral in sight. Mr. L. W. Stillwell, of Deadwood, reports having shipped 400 pounds of select material, during the year past, for jewelry and ornamental work. Some available for similar uses, and almost as good in color, has also been taken out at Yokohol, Tulare County, Cal.

RUTILATED QUARTZ.

NORTH CAROLINA.

A fine quality of rutilated quartz, well crystalized and perfectly transparent, is found in the monazite mines near Shelby, Cleveland County, N. C., together with handsome garnets.

AMETHYST.

NORTH CAROLINA.

Mining for amethyst has met with considerable success at Tesanty, on the creek of that name, Smith Bridge Township, Macon County, N. C., where a large vein occurs in an altered pegmatite. The development thus far has been entirely in a kaolinized rock in which the amethyst crystals, from one-half to 3 inches in length, are found loose with the quartz and mica in the kaolin. The entire vein when found had been uncovered to the depth of 20 feet by a landslide. It is evident that further working will show the amethysts in the rock. In color the crystals are light and dark, the dark spots often of the deepest, richest purple; no finer amethysts have been found in the United States. Several thousand dollars' worth of stones were sold from the first development work.

ALASKA.

During the past year some specimens of amethyst crystals containing fine material were brought to the United States from Alaska. Further development of the amethyst vein known to exist is expected.

BRAZIL.

Brazil, one of the richest countries of the world in minerals, has for more than half a century been in constant communication with Germany in the matter of precious and semiprecious stones, as a leading source of supply to the celebrated polishing works at and near Oberstein, in the valleys of the Nahe and the Idar. The last-named stream, a tributary of the former, has its source in the neighborhood of Erbeskapples, the highest point of the Rhine province, in the elevated forest region of the Hunsrucks. In its descent to the Nahe, near Oberstein, it presents a succession of falls through a distance of about 24 miles, and supplies water power for more than sixty polishing works. The valley has a large population, the principal towns being Oberstein, which is a station on the Nahe-Rhine Railway, and Idar, half an hour distant by train, on the river of the same name. These two towns receive precious and semiprecious stones for polishing from all parts of the world and export their products in like manner everywhere, manufacturing many special styles of work adapted to the tastes and demands of numerous races and tribes, both civilized and uncivilized. Oberstein, formerly entirely an agate-cutting district, is occupied especially with the watch-chain industry, while the more general work in precious and semiprecious stones is in the hands of the Idar merchants.

As the polishing industry has developed, the usual change has taken place from the water power which originated the industry to the use of steam, and lately to the use of electric motors. Not only is a great increase of power thus obtained, but the danger of lack of water in summer and the interruption by freezing in winter, both of which have been serious embarrassments, are alike obviated.

All kinds of precious and semiprecious stones can be and are polished at these numerous works, among the former being diamonds, rubies, emeralds, sapphires, etc., and among the latter agates, amethysts, opals, topazes, and the quartz gems in general. The polished products find ready sale all over the world. At times when one or another variety is out of fashion, and hence not in demand for jewelry or for decorative work, the stones are put aside and kept in reserve until the public taste or fancy changes and brings them again into favor.

Brazil has long furnished many varieties of the quartz gems, and of late has yielded especially the remarkable "almond agates" in great quantity, as well as the purple amethysts, which have held their place steadily in public esteem, despite the competing attractions of other gems. This enduring favor is largely due to the fact that there is in reality no other precious stone with the beautiful violet color of the amethyst.

German agents and explorers are constantly engaged in the search for new localities and varieties of gem stones in Brazil, and indeed in many parts of the globe, to supply material for the Idar and the Oberstein works. In the course of such exploitations there was found a few years ago an immense hollow "almond," or amygdaloid geode, of amethyst; or, in other words, a single amygdule in an igneous rock, far surpassing in size and elegance anything of the kind previously known.

This wonderful geode or "druse" measured about 10 meters (33 feet) in length, 5 (16.5 feet) in width, and 3 (10 feet) in height, and was estimated to weigh some 70,000 pounds (35 tons). It was lined with quartz, colorless at first, near the outside, but passing gradually, toward the interior, into a lining of richly colored amethyst crystals, many of them as large as a man's fist, and with brilliant, lustrous faces, as though polished by a lapidary.

It is unfortunate for science that a specimen so unique in its magnificence should not have been preserved. But since the first discovery many parts have been broken away, and many lots bought by various gem prospectors for special uses, until there was no possibility of saving it as a whole. It has been partly put together as the "Amethyst Grotto," shown in the Düsseldorf Exhibition of 1902 (class 11).

The mode of occurrence of this great amygdule or geode may be briefly described as follows: The Serra do Mar, the mountain range parallel to the Brazilian coast, on passing into the State of Rio Grande do Sul, turns toward the west and declines in height, but its southern slope is somewhat rugged. Here are situated a number of German settlements, as Santa Cruz, Germania, St. Angelo, Silvina, Martens, New Berlin, Teutonia, New Petropolis, St. Leopold, etc., with a German-speaking population of perhaps 200,000. In Santa Cruz are many immigrants from Idar and its vicinity, who are of course familiar with the nature and occurrence of precious and semiprecious stones. The Serra is largely composed of granitic and igneous rocks, frequently covered by a mantle of red clay, resulting from the decomposition of the rocks by weathering. At an elevation of from 500 to 1,000 feet (150 to 300 meters) above the sea, a red rock is largely present which often passes into melaphyr and amygdaloid, in which agates frequently occur.

The principal district in which the agate amygdules are obtained is along the upper waters of the Garuky and its left-hand tributaries, north of Santa Cruz. They are generally found in the red soil above referred to as produced by the weathering of the igneous rocks. In the case of the great geode, this was true of its upper portion, while the lower part remained embedded in the underlying melaphyr. It was hence very difficult of extraction, especially as blasting could not be employed for fear of injuring or dislodging the elegant crystals. The upper part of the geode had been broken open, and the interior was filled with the red soil, in which, as in a unique flowerpot, had grown a palm 4 meters (13.5 feet) in height.

The spot where it was found was north of Santa Cruz, and only 20 miles distant in an air line, but the paths down the mountain side are suitable only for transportation on mule back. Hence the large and heavy pieces, into which the great geode, or what remained of it, was finally broken, had to be carried by a much longer and very roundabout way to reach a point of shipment. The pieces were ten in number and weighed 1,500 kms. They were carried on two-wheeled carts, each drawn by eight oxen, across several mountain streams to Villa Birra; then, by the Harrara railway to Santa Maria; then, on the Urugaryan railway, for 262 ks., to Targum-Taquary; thence by river steamer to Porto Alegro, and by raft to Rio Grande, where they were at last shipped to Europe. The finest parts of this grotto have been presented to the Tiffany-Morgan collection in the American Museum of Natural History, at New York, and to the Musée d'Historie Naturelle, Jardin des Plantes, Paris.

CAIRNGORM STONE.

SCOTLAND.

At the meeting of the British Association for the Advancement of Science in 1901,[a] Mr. E. H. Cunningham Craig gave an account of the celebrated locality of smoky quartz, Scotch topaz, or cairngorm stone, so called from Cairngorum, near Banff in Scotland. The search was formerly quite profitable, but is now very little prosecuted. At points near the great granite masses, shallow pits or trenches were dug in the decomposed rock that covers many of the flat hill tops and appears in the "corries" or ravines. Pieces of vein quartz, with muscovite and orthoclase crystals, in the decayed rock were regarded as surface indications of cairngorm veins beneath. Sections in the "corries" show vertical or steeply inclined veins (or dikes) of fine granite traversing the coarser surrounding rock. These have a central zone of drusy cavities and coarse crystallization with plates of muscovite, crystals of orthoclase, and more or less smoky quartz, together with occasional beryls. The mode of occurrence seems to be identical with that of the amethyst crystals in this country from Maine to Georgia. Mr. Craig regards these veins as intrusions of a more highly differentiated material from and underlying magma into fissures formed in cooling. To the drusy cavities he attributes a like origin, and a subsequent filling with acidic solutions from which the crystals developed.

NONCRYSTALLINE QUARTZ.

Numerous occurrences of the minor varieties of noncrystalline quartz minerals are reported every year. Some of these never prove important, while others may. In many instances, however, they possess interest and serve to develop more or less business in "local" gem stones. Among those lately announced, the following may be referred to:

AGATE.

Some fairly good material, of red and other colors, has been obtained in Clarke County, Ala., and has been cut and polished in New York for sets of cuff buttons, etc., and for ornaments and small slabs. Prof. Eugene A. Smith, who reports these facts, states that this agate occurs in veins in the "Buhrstone" division of the Claiborne formation, in the Eocene Tertiary.

Agate pebbles, or rather nodules, occur in and around the city of St. Paul, Minn., in the sand and gravel of the soil. They vary from very small size to that of a hen's egg. Mr. E. C. Mitchell, president of the St. Paul Academy of Sciences, says that while few, especially of the larger ones, are at all choice, yet handsome agates are obtained at times.

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[a] Report Seventy-first Meeting, 1901, p. 654.

Mr. J. T. Jamison, of Mathis, Tex., reports very pretty moss agates from that vicinity, but not in any quantity.

Moss agate from Oregon is described further on under jasper.

It was reported lately from Philadelphia that a large vein of mottled and banded agate had been discovered on Chickies Ridge, Lancaster County, Pa., from which pieces large enough for table tops could be taken.

CHALCEDONY.

Beautiful chalcedony pebbles are found among the sand and gravel at low tide, north of the pier at Redondo Beach, California. They are believed to have come from strata of sand extending for a mile in the vicinity. Several of these pebbles have also been found during the past year in an Indian grave north of Redondo.

CHRYSOPRASE.

More or less mining has been done at the several chrysoprase localities in Tulare County, Cal.; and a portion of the material taken out is really fine enough to be valued for cutting. At the original locality at Venice Hill, 12 miles northeast of Visalia, some 300 pounds of chrysoprase were obtained. The parties who are working at this point have secured several thousand acres of adjoining land, and also the locality near Lindsay, 18 miles southeast of Visalia. This was first announced in Mineral Resources for 1898[a] as a chrysoprase locality; but Mr. Braverman, who has given so much study to these occurrences, now calls it prase-opal. From the workings at Deer Creek[b] some 1,200 pounds were shipped to New York, but work has been suspended for a time.

Mr. J. A. Edman, of Meadow Valley, Plumas County, Cal., reports prase as occurring in lenses in the serpentine belt and as pebbles in adjacent gravel deposits. It varies from light grayish-green to deep green, the latter said to be peculiarly suitable for ornamental uses. In Mineral Resources for 1899[c] green jasper was announced in a like occurrence at the same place. Whether both prase and jasper are thus found, or whether both are really a form of chrysoprase, is not yet certain.

JASPER.

OREGON.

A discovery has been made of true bloodstone or heliotrope, and also of fine moss agate at Hood River, Wasco County, Oreg., by Miss

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[a] Twentieth Ann. Rept. U. S. Geol. Survey, Pt. VI (continued), 1899, p. 589.

[b] Eighteenth Ann. Rept. U. S. Geol. Survey, Pt. V (continued), 1897, p. 1207.

[c] Twenty-first Ann. Rept. U. S. Geol. Survey, Pt. VI (continued), 1901, p. 455.

Nettie Hayes. The heliotrope is in fair-sized pieces, of deep green, with the red spots that characterize the variety well marked, making specimens as fine as those of India. The moss agate is not in rolled nodules, like many of the Western specimens, but in fragments, evidently from a vein or deposit. They are somewhat angular and only rounded on the edges. The markings are very fine.

CALIFORNIA.

Mr. J. A. Edman, of Meadow Valley, Plumas County, Cal., states that jaspers occur frequently thereabout, chiefly gray, light red, and white and red mixed, some of which would be suitable for ornamental use.

MINNESOTA.

Prof. Raphael Pumpelly reports a blood-red jasper and also a blue-gray chalcedony as occurring in the region west of Lake Superior. They are found in great abundance, the former on Hunter's Island, and the latter near Gunflint Lake, both of which are on the boundary line of Minnesota and Ontario.

NORTH WALES.

A very remarkable discovery of jasper is announced in the English press as having been made in South Carnarvonshire, at Carreg-y-Plas, North Wales. The deposit appears in very large veins, from 10 to 40 yards in width, exposed at intervals along the shore cliffs for some distance from Porthper Bay. The color is chiefly deep red varied with lighter tints, and the supply of material seems enormous. Specimens cut and polished at Birmingham are of fine quality and much admired. A syndicate is already proposing to undertake active work.

PETRIFIED FOREST OF ARIZONA.

In my last report[a] is given a résumé of the report of Dr. Lester F. Ward on the geological relations of the petrified forest of Arizona, made under directions from the National Museum and the General Land Office. The agatized logs were described as all washed out of a bed of coarse sandstone several hundred feet above the areas in which they now lie, and a few points were noted where they may be seen in place in the sandstone. This bed was referred in a general way to the Triassic.

In a subsequent paper,[b] Professor Ward has followed up this subject in a highly interesting manner. He describes the whole succession of Triassic beds in the region traversed by the Little Colorado River, and for the first time distinguishes them into definite series. He has traced three main divisions, which are named in ascending order, the Moencopie, the Shinarump, and the Painted Desert beds. The middle group, the Shinarump (already so named by Powell), is the source of the silicified logs. They occur more or less distributed through its entire thickness of 1,600 feet, and Professor Ward uses the presence of the fossil wood as a criterion to define the limits of the formation in certain cases, so characteristic is its general occurrence. There is a well-marked division of the Shinarump into a lower and an upper portion about equal in thickness (the latter of which he names the Le Roux beds), and there is much lithological variation in both members, but the wood appears throughout. The lower division is largely sandstone and conglomerate, but interstratified with shales and marls, which often present brilliant colors, and all these together form the striking banded bluffs around the eroded areas of the Petrified Forest. The upper division is principally a body of variegated marls, especially conspicuous at the Middle Forest, which lies amid these Le Roux beds, while the other parts are in the lower section of the Shinarump.

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[a] Mineral Resources U. S. 1900, pp. 763-766.

[b] Geology of the Little Colorado Valley: Am. Jour. Sci., 4th ser., Vol. XII, No. 72, Dec., 1901.

These determinations by Professor Ward are of great interest, both as to the general geology of the region and as defining the exact horizon of the remarkable agatized forest.

In further prosecution of the same subject, much interest attaches to discoveries of other localities, where the agatized trees are apparently in place, reported by Mr. James M. Pulver, Territorial geologist of Arizona. He and his party found a fine group of fossil trunks in the foothills 12 miles east of Winslow, Ariz., about 45 miles from Chalcedony Park. Here great trees were standing erect, looking like the pillars of an ancient temple, in the face of a perpendicular sandstone cliff. Some were 20 or 30 feet high and 4 to 6 feet across, and with roots running out below into the inclosing rock. One had fallen, leaving its niche or mold in the face of the cliff; others were precariously exposed; others just appearing, indicating that the rock was full of them. All about through the sandstone were branches, leaves, and fruits, from which it was seen that some of the trees were of a coniferous type, similar to the Sequoia, and others were angiosperms.

Another fine locality, though of limited extent, was found some miles farther west. Here, on a mountain slope, is a small forest, very perfectly preserved, even to the bark and roots. One large stump, on the summit of a little isolated mesa, with roots in position, measured 14 feet in height and 26½ feet in circumference at its base. The silicified tree, with its roots, had evidently preserved the surrounding material from complete erosion, and thus in a sense formed the little mesa on which it stands.

The precise geological relation of these localities to the Shinarump horizon of Professor Ward is not given, and its determination will be of much interest.

New localities are constantly reported by prospectors and cowboys, and it seems evident that the fossil trees are widely distributed throughout northern New Mexico and Arizona.

It would appear that this material was well known and highly valued among the Indians long before any whites had seen it, as many objects of use and ornament made from it—pestles, arrowheads, charms, etc.—are found from Zacatecas on the south to Wyoming on the north. The first white man who ever saw the locality is believed to have been Col. John W. Stedman, in 1851, who learned of it from some of the Zuñis. A year later Prof. Jules Marcou, with a party of United States surveyors, examined the spot and made collections and reports. In the year following Lieutenant Whipple reached and named his "Lithodendron Creek," which must have been some part of the Chalcedony Park, although Dr. Ward, as above noted, does not think that it was the main arroyo which he describes. From these reports of Government officers it became gradually known, though it was too remote for access by the tourist and the vandal until the opening of the railroad in 1880.

OPAL.

NEW MEXICO.

A very interesting variety of green semi-opal has been discovered in Taos County, N. Mex., by Mr. A. C. Twining. The particulars of its occurrence are not yet reported.

CUBA.

Moss opal, in masses larger than a man's fist, has been found in a bed of white cherty rock on the banks of the Yucatan River at La Cieba, 8 miles north of the city of Puerto Principe, Cuba, by Mr. C. H. Drake, of that place. The moss opal in general appearance closely resembles the large masses of moss agate found near Hartville, Wyo., but is entirely opal and not quartz.

AUSTRALIA.

NEW SOUTH WALES.

The opal production in New South Wales, especially in the remarkable White Cliffs region in Wilcannia district, is described in the reports of this survey for 1896 and 1898.[a] According to Mr. E. F. Pittman, in his work The Mineral Resources of New South Wales, this rich opal field was first discovered by a mere accident, as indeed has often been the case. In 1889 a hunter following a wounded kangaroo noticed a piece of bright-colored opal on the ground and picked it up. Further search revealed other pieces; trenches were then dug, and the mineral was discovered in place. From that time mining has been carried on more or less continuously, though much hindered at times by lack of water. Still, it has become a fixed industry, and a prosperous township has been established at White Cliffs. The total yield since the discovery is estimated at £376,600, but it must really be much larger, as a great deal of the opal found is not reported.

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[a] Eighteenth Ann. Rept. U. S. Geol. Survey, Part V (continued), 1897, p. 1208. Twentieth Ann. Rept., Part VI (continued), 1899, pp. 589–595.

The mineral occurs in seams or layers in Cretaceous deposits, as described in the reports above cited. The variety of color and pattern is very great, and prices range correspondingly, from quite low up to $100 or even $125 an ounce, which is the unit of purchase in the rough. The types of pattern and color are described in a previous report.[a] Some other features as to the value of stones for jewelry may be here noted. The shape of a piece of opal may be important, as affecting the disposition of pattern and color, which may be fine on the edge and less so on the face, or vice versa. A thick piece, with a good edge pattern, may be cut up into a number of small fine stones, using that pattern for their main face; a thin piece, equally good in the edge pattern, could not be so treated. It is not easy to obtain separate stones of uniform character for sets of jewelry, and so such sets are usually cut from a single large piece, which is therefore worth much more per ounce than a corresponding number of smaller stones, equally fine, but not quite similar. The ground or body, again, is important; it should neither be too clear nor too opaque; and another difference lies in the matter of toughness or brittleness, in which the stones vary somewhat, greatly affecting their cutting and wear. Some single pieces from these mines have brought very high prices; one of 4½ ounces was sold for £100, and another of 9 ounces was valued at £700. These were local prices and would have been much higher in London.

Dr. George Gurick in an exhaustive article[b] describes fully his studies of these very interesting White Cliffs occurrences of noble opal and opal pseudomorphs. These deposits have been described from time to time by Dun[c] and in many other publications cited by Dr. Gurick in his article.

Dr. Gurick classifies the opal occurrences in the following five classes:

1. As material filling small rents in various rocks, as sandstone, often rich with feldspar.
2. As material filling cracks and wormholes in opalized wood.
3. As the cementing material of a sandstone.
4. As a fossilizing material of wood, of Devonian crinoidal stems and parts, and of brachiopods and saurian bones.

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[a] Twentieth Ann. Rept. U. S. Geol. Survey, loc. cit.

[b] Neues Jahrbuch für Mineralogie, Vol. XIV, pt. 3, pp. 472–783.

[c] Records Geol. Survey New South Wales, Vol. IV, Pt. IV, p. 300.

5. As first large pseudomorph after a radial crystalline aggregate. All these varieties are often opals of great beauty. Dr. Weisbach believed that the crystalline aggregates were originally sulphur. Dr. Pelikan believed them to be gypsum crystals. Dr. Gurick, however, infers that they may be after gaylussite, similar to those from northern Germany. He also believes that where the noble opal shows by transmitted light a network of color slightly different from the mass itself, it may be a pseudomorph after calcite; yet at the same time it may be a minute remnant of the cellular structure of the saurian bones. This locality has produced during the past ten years more opals, and as fine if not finer ones, than have the famous Royal Hungarian mines in the centuries of their production. The stones are often of great size. They occur of the purest white with all the play of color that has been seen in opals from any precious opal locality, and the color reflections often have a great variation. More opals are now sold in a year than were sold in fifty years before the Australian mines were opened.

TURQUOISE.

Turquoise mining has been active during the last year. There are at least six companies now engaged in working for American turquoises, and it is a question that only time can decide how much increase of output the market will stand. Thus far, however, as the multiplication of companies shows, there is no sign of oversupply; the gem is in high favor, and novel and varied forms of cutting and setting it have been lately introduced.

Turquoise mines have now been found in at least five States and Territories—Arizona, New Mexico, California, Nevada, and Colorado.

COLORADO.

A new and apparently fine locality for turquoise has been discovered in Colorado, at Lajara, a mile and a half west of the Rio Grande and 10 miles north of the New Mexico line. This, which is the first mine in the district, was discovered early in 1901. It is located in a little volcanic hill, and is surrounded with the usual evidences of ancient working—stone hammers, pieces of deerhorn, and the like. A large mass, reported to weigh 1,500 carats, was brought to Denver during the summer and greatly admired. This was not, however, pure blue turquoise, as was claimed in press notices, but was probably a rich piece of matrix. A company has undertaken to develop this mine and has located several claims.

NEVADA.

Another locality for turquoise in Nevada has been announced during the year past. Mr. William Petry, of Los Angeles, Cal., has discovered a new deposit on Cactus Mountain, 50 miles east of Butler, Nye County, Nevada. The turquoise was traced by a large quantity of broken material on the surface. A stone, weighing some 8 carats, was found, but the color is not the finest blue. Considerable work is being carried on in the hope of further developments.

ARIZONA.

Mr. C. D. Childers, also, of Whitehills, Mohave County, Ariz., has described what is apparently a new turquoise mine in that Territory near the Colorado River. Like all the rest, it bears evidence of former working, by Indians or earlier prehistoric people, in the form of stone hammers and carvings on adjacent rocks. No other particulars have yet been obtained.

NEW MEXICO.

In New Mexico, according to the published report of Governor Otero, there are some 60 or 70 turquoise claims, of which 10 or 12 are being worked with profit. Six important companies, as above stated, are actively at work and are furnishing the bulk of the world's supply.

During the Southwestern tour of President McKinley four beautiful turquoises from the Porterfield mines in the Burro Mountains were presented to him by Governor Otero. The largest stone was a superb specimen of 20 carats weight.

Turquoise is occasionally liable to fade. Some of the companies claim that their stones never change or lose color; if so, indeed, it is a remarkable fact in the case of a mineral so long regarded as unstable in this respect. Several of the companies give a guaranty that if one of their stones changes color within six months after its purchase from a retail jeweler, they will replace it with a new one. This is a great improvement on the old method of the Persian dealers, who were wont to decamp for parts unknown as soon as their turquoises were sold. In order to protect themselves against false claims the several companies have adopted the system of marking each of their stones by cutting a trade-mark on the back, an A for the American Turquoise Company, a circle for the Azure Company, a cross for the American Turquoise and Copper Company, a T for the Toltec, an arrow for the Himalaya, etc.

APATITE.

An unusual occurrence of apatite was made known in the fall of 1900, at Auburn, Me., on the farm of Mr. P. P. Pulsifer. The mineral was found in a matrix of quartz, and appeared in beautiful prismatic crystals, often transparent and richly colored, notably a fine purple in lighter and darker shades. It was first supposed to be tourmaline, and was announced as such. The whole "find" was purchased for the collection of Harvard University.

CONCHITE.

The new variety of calcium carbonate described under the name of conchite by Miss Kelly,[a] as well as that of Mr. Lacroix, called by him ktypteite, are questioned by Dr. H. Vater[b] and are held to be not really distinct from aragonite.

AMBER.

Dr. Hapke states in a recent article[c] that as early as 1875 seventy-five localities in northwest Germany where amber had been found had been described in the Journal of the Natural History Society of Bremen. He notes five new occurrences in that region, thus making eighty in all. He mentions a single enormous piece weighing 3.125 kilograms, 6.875 pounds, of mingled straw color and greenish yellow, which had been found in the 70's by some fishermen in Langlutjensand. Other discoveries had also been made in clay and sand in Binnenlande. This amber of the northwest coast rarely shows inclosures, as it is mostly opaque or subtranslucent. Quite recently a rich discovery of amber has been made in the Elbemundung by crab fishers. One beautiful piece from Altenbruch weighs half a pound.

Dr. Goetze mentions[d] the finding of amber in pieces weighing 200 grams—one-half pound—on the left bank of the Weser, at Blexen, opposite Geestemunde, in a brown to black deposit.

EPIDOTE.

Mr. O. H. Blocker, of Old Fort, N. C., sends for examination some interesting crystals of epidote in brilliant prisms 1½ inches in length, one-eighth inch in diameter, and dark green, but too dark to have value as gems. They are reported to occur 40 miles from Old Fort. The property may be explored further.

CHLORASTROLITE.

This mineral, long familiar from Isle Royale, Lake Superior, is announced as obtained also from Green Stone Island, south of the Isle Royale. No particulars are yet forthcoming.

ZOISITE.

Dr. F. Slavik[e] discusses the occurrence of the well-known Moravian pink zoisite, describing the various localities and occurrences and giving an analysis made by Prof. Fr. Kovar, of Prag, who has chemically investigated the red zoisite of Borovina with the following results:

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[a] Mineral Resources U. S. 1900, p. 776.

[b] Zeitschrift für Krystallographie, Vol. XXXV, p. 149.

[c] Nachtrag zu den Bernsteinfunden: Beiträge zur nordwestdeutschen Volks- und Landeskunde, herausgegeben vom Naturwissenschaftl. Verein zu Bremen, Abhandl. 15, Heft 3, 1901, pp. 307-310.

[d] Bernstein an der Wesermündung: Zeitschrift für Ethnologie, 34, 1900, pp. 428, 429.

[e] Centralblatt für Mineralogie, 1902, p. 686.

Analysis of zoisite.

Constituent.	Per cent.
SiO_2	38.91
Al_2O_3	29.38
Fe_2O_3	4.46
MnO	0.17
CaO	25.18
MgO	0.44
H_2O	2.06
Total	100.60

Zoisite has recently been used to some extent as a gem stone in the form of small round spheres.

MISCELLANEOUS.

Mr. Wm. E. Hidden reports a number of interesting minerals that may possibly prove to be of gem value, though as yet undeveloped, from Mason's Branch, Macon County, N. C. Among these are green spinel, translucent and glassy; iolite, clear and chatoyant; sapphire corundum, in promising crystals; and bronzite, pale, transparent, and bronze-tinted.

GEM CUTTING IN THE UNITED STATES.

Within the last few years more attention than ever has been paid to the quaint and fanciful cutting of all precious stones, including the diamond. Whereas ten years ago scarcely any other form than the "brilliant" and the "rose" in diamonds were used, of late there has been a great demand for stones that are "pear-shaped," "marquise," "briolette," and for table-cut stones in all forms—triangular, circular, hexagonal—and for stones cut also in the double rose, or "rose-brilliant" form. A modification of the latter, bearing 80 facets, 40 above and 40 below, has been patented under the name "twentieth century cutting." This is not unlike the old-fashioned rose-brilliant, in which some fancy stones have also been cut for some years past, but omits the culet and table entirely.

The inventor claims that by eliminating the table and the culet the brilliancy of the stone is greatly increased. His patent is essentially on a shape formed of two cones, base to base, each cone made up of planes. Eight diamond-shaped planes meet at each apex, taking the place of the table at the top and the culet at the bottom of the present brilliant.

An instance of where a change of fashion or a lower rate of wages affects an industry may be recognized in the fact that from 1866 to 1882 there were employed in the city of Providence, R. I., from 75 to 100 men engaged in the lapidary business, earning from $18 to $30 per week. A large part of the time they were engaged in cutting Wyoming moss agates and what was known as the Montana agate, which commanded a price of from $4 to $12 per dozen. But the cutting of these stones abroad at $4 per gross resulted in an entire collapse of the industry. A similar fact was also instanced when cameos and intaglios were in fashion, a period ranging from 1865 to 1885, when fully 100 men were engaged in cutting intaglios and cameos in the city of New York. To-day there are less than four men so engaged, in consequence of the change of fashion, which has not favored that style of ornaments for some years past, though now there are indications of a return to them.

GEM CUTTING IN EUROPE.

GERMANY.

Although there are only about 120 diamond cutters at Hanover, and not more than twice that number in all Germany, yet the Prussian commission of commerce has had under consideration the placing of a duty of 25 per cent ad valorem on all cut diamonds brought into Germany, which at present represent a value of about $4,000,000. The United States is the largest consumer of diamonds. The duty on cut diamonds is 10 per cent ad valorem, and rough diamonds are free.

The jewelry industry of Germany is to a considerable extent concentrated at the little towns of Hanau and Pforzheim, near Frankfort on the Main, and at the Oberstein-Idar district elsewhere described. There were in operation last year in Pforzheim more than 400 jewelry manufactories, giving employment to over 18,000 persons and producing an output valued at more than 60,000,000 marks.

NETHERLANDS.

The combined diamond-cutting industry of Antwerp and Amsterdam employs about 4,000 men.

A serious strike has recently taken place among the Dutch diamond cutters, which has produced considerable agitation and trouble.

FRANCE.

A commission appointed by the minister of commerce to gather statistics as to the industrial position of France has recently examined and reported upon 38 establishments for working in precious metals and gems, most of which are in the Department of the Seine. There are three workshops for the cutting of diamonds and other precious stones, employing 130 persons, of whom 15 per cent are women and children. The day is of ten hours, and the average daily wage is 8 francs. Four establishments for cutting imitation gems were also visited; these employed 80 persons, 16 of whom (20 per cent) were women. The day in these is eleven hours and the average pay 5 francs.

GEM-CUTTING APPLIANCES.

A great number of ingenious and intricate devices have been invented and patented during the last few years for the cutting of diamonds and other precious stones, a fact which bears evident testimony to the growth of interest and of business in this line. Among these, one of the latest is really in principle only an improved adaptation of a simple device that was used in Europe during the last century, and is still employed in Russia and to some extent in France. This is known as the cadrans.

One of the new machines combines the features of this apparatus and of that employed in cutting the teeth in clock wheels, but is more complicated than either. It is very neatly constructed and weighs only about half a pound. A standard, adjustable both vertically and horizontally, carries a screw shaft support which is capable of being revolved about the standard and fixed in any position and at any desired angle. Adjustment pins on the side regulate a pointer on a scale or small dial at the top of the machine, showing the exact inclination at which the stone is held by the shaft. It is claimed to be possible so to adjust the position of a stone that a series of facets—four, eight, or more—may be cut on a piece of gem material at any given angle and each angle and facet be mathematically symmetrical.

ANCIENT JEWELS.

Among the most remarkable discoveries ever made of ancient Egyptian jewelry are those of Prof. Flinders Petrie, in his recent excavations at Abydos. The date which he assigns is as remote as 5000 B. C., but the workmanship in gold and jewels is marvellous. In exploring the tomb of King Zer, of the earliest of Mr. Petrie's pre-Menean dynasties, it was found that the tomb had been entered for robbery at some unknown period in the past, and the plunderers had broken off the arm of the queen's mummy and hidden it in a crevice of the wall—perhaps on being disturbed or alarmed—and had never returned to remove it. On taking off the wrappings Professor Petrie found four magnificent bracelets of gold with amethyst, turquoise, and lapis-lazuli in varied and elegant adjustments. The gold work was exquisitely fine and delicate, though the metal was pure and soft, apparently with no hardening alloy. The stones were beautiful and very strikingly and peculiarly arranged.

Mr. Edward Ayer, of Chicago, Ill., possesses a number of amethyst beads, about a quarter of an inch in diameter, of the richest and deepest purple, obtained by him at Dashour, Egypt, from the treasure in the tomb of Princess Meret, daughter of Amenhotep II, of the twelfth dynasty.

COLORS OF PRECIOUS STONES.

The colors of gems, and their liability at times to fade or to change, are of much scientific interest and also of considerable practical importance. Much may be learned, undoubtedly, concerning these questions by careful experimentation with glass and like substances. These subjects have been studied with great care for years past, and some valuable publications thereon have been issued by the late Mr. Thomas Gaffield, of Boston, Mass., a scientific glass manufacturer.

As early as 1863 he began experiments as to the action of sunlight in changing the color of glass, which have thrown light to some extent upon similar phenomena in precious stones. Mr. Gaffield, who died December 8, 1901, had made extensive collections of specimens and books illustrating these studies and experiments and the whole subject of glass and porcelain manufacture. These he bequeathed to the Massachusetts Institute of Technology, and his minerals and gems were largely presented to the Boston Society of Natural History.

LITERATURE.

PRECIOUS STONES ON NEW YORK ISLAND.

The reports of this Survey have contained from time to time notices of gem minerals—though rarely of gem quality—found on the island of New York, or more strictly, Manhattan. To these, chrysoberyl is added in the present report (p. 26) from a new locality. Some of the Manhattan beryls have been cut and mounted, but among the garnets, beryls, tourmalines, zeolites, and smoky quartz of the island few specimens are capable of such use, though many are interesting and sometimes remarkable as minerals. A valuable pamphlet on the geology and mineralogy of "Greater New York," including the five boroughs lately consolidated (Manhattan, Bronx, Queens, Brooklyn, and Richmond), has appeared during the year from the pen of Dr. Louis P. Gratacap, of the American Museum of Natural History.[a] It is a very complete and up-to-date handbook of the geological structure, topographical features, and mineral contents of this interesting area of the great metropolis.

PRECIOUS STONES OF MADAGASCAR.

A notable pamphlet has lately appeared on the mineralogy of Madagascar by Prof. Alfred Lacroix, of the Musée d'Histoire Naturelle of the Jardin des Plantes at Paris.[a] After treating of the general geology and mineralogy of the island, Professor Lacroix gives several pages to the precious stones. Diamonds are unknown, but corundum, spinel, chrysoberyl, topaz, beryl, garnet, tourmaline, and various quartz minerals are found in the auriferous alluviums, gathered by a natural concentration process, due to their density and hardness. Some of these species are also known in crystals, and even in the matrix, especially the fine colored tourmalines. The rolled grains or little pebbles in the alluvium are clear and brilliant, but rarely large enough to be valuable, but few of the crystals have anything like such purity and elegance. This fact, which is general and in no wise peculiar to Madagascar, Professor Lacroix points out as due to the fact that crystals are apt to be fissured, and that thus, as well as by cleavage, they break up in the process of rolling and attrition in stream beds; it is the purest and finest portions that resist longest and so form a large proportion of the pebbles and grains.

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[a] Geology of the city of New York, by L. P. Gratacap, published by the American Museum of Natural History. 82 pp., illustrated, 8°, 1901.

The corundum is sometimes colorless, pink, or a pale shade of blue or green, but generally very deep blue—too dark, indeed, for setting unless in very small stones. The rolled crystals show planes of the hexagonal prism, the base, and a very acute pyramid, and closely resemble those of Puy de Velay, in France. Their source is unknown as yet, whether from the volcanic rocks of the central "massif" or, as Professor Lacroix thinks more probable, from the gneisses and granites. Crystals of opaque corundum also occur.

Spinels, green but not of gem quality, are associated with the corundum. They are rolled out of all distinct crystalline form, but a similar spinel in distinct crystals occurs in limestone near the capital, Tananarive.

Cymophane (chrysoberyl) is here announced for the first time from Madagascar. It is abundant at several placer localities in the form of grains, transparent, and of beautiful color, and it would be a fine gem stone if it could be of sufficient size. With it, and closely resembling it, are grains of yellow tourmaline, distinguishable by their lower hardness and density and greater fragility.

Topaz appears in rounded grains resembling quartz. It is similar to that of Brazil, and would be of value if larger sized material could be found. Thus far none have exceeded a diameter of 4 mm.

Beryl (aquamarine) is obtained of green or light blue color and one specimen of a delicate pink;[b] but none have been seen in place. This and the two preceding species are judged to be from disintegrated pegmatite.

Garnets are by far the most abundant species, being found in almost every stream bed of the gneissic region, and in place in the gneiss and in the pegmatite. These are chiefly almandites, well crystallized in the usual forms. An orange-yellow grossularite, or essonite, appears in some of the gold placers.

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[a] Madagascar au début du XXme Siècle: (extrait) Minéralogie, par A. Lacroix, Paris, Société d'Éditions Scientifiques et Littéraires, Jan., 1902, 41 pp., 8vo.

[b] A fine pink crystal and a pink gem are in the Tiffany-Morgan collection, American Museum of Natural History, New York.

Zircon, in small rolled crystals, is found in the same alluvium, but nothing of gem quality.

Triphane (spodumene), transparent and light pink, is known from a single specimen. It might be an attractive gem stone if found in any amount.

Tourmaline is much the most important precious stone of Madagascar. The colored lithia types are found of a size and beauty equaling those of Brazil, Ceylon, or the Urals. The fragments in the streams are generally homogeneous in color, but the crystals exhibit the polychromatic character so frequent in this species, often being, like the Brazilian specimens, red within and green externally. A citron-yellow type is not uncommon, and occasionally a pure ruby red. A fine golden-yellow specimen was shown at the Paris Expositien of 1900.

The crystals are found in place in quartz veins in the pegmatites at several localities mentioned.

Black tourmalines also abound in the pegmatites, often large, very regular in form, and very pure.

Other minerals of the pegmatites that may prove of gem value are a beautiful green microcline (amazon stone), an opalescent orthoclase (moonstone), and klaprothite (lazulite) of a rich Prussian blue.

It is for its masses of hyaline quartz, however, that Madagascar has been noted since the middle of the seventeenth century, when large irregular blocks of this material were first reported by travelers. In 1658 Flacourt, in his history and map of the island, indicated its occurrence at various points along the streams entering the sea opposite and near to Isle Ste. Marie, on the east coast. Since then many specimens have been brought to the museum at Paris, all of similar character. It occurs throughout the central gneissic region, especially in the northeastern part, and along the coast in the neighborhood of Vohémar. It has been obtained principally from this port and carried elsewhere by native boats and other vessels; whence the name of Vohémar has been generally given, in commerce and in collections, as the locality for all Madagascar quartz.

Thus far only rolled masses from stream beds have been used. These are for the most part completely rounded, but sometimes large crystals of good form are found, weighing several hundred kilograms, and for purity, brilliancy, and perfection, unrivaled at any other known locality. Two-thirds of all the crystal balls sold as Japanese are really of Madagascar origin, and are cut either in Germany, France, or the United States. They are frequently over 5 inches in diameter. The writer saw a heap of 50 tons of transparent material in Paris in 1891. Fine crystals are in the American Museum of Natural History and the Field Columbian Museum. The material is largely limpid and colorless, but is often full of fluid cavities disposed in horizontal or curved planes; and when these become very abundant the quartz is rendered milky, and hence unsuitable for either optical or ornamental uses. Some smoky quartz occurs with it, but in much less abundance.

The quartz with inclusions is also often in large pieces, which when polished form magnificent cabinet specimens. Examples may be seen in the Tiffany-Morgan collection at the American Museum of Natural History, and in the Tiffany-Higginbotham collection at the Field Columbian Museum, Chicago.

The sources of this material are not yet known, and Professor Lacroix speculates somewhat as to whether it comes from quartz veins or from the pegmatites. The latter view is favored by the occasional presence of inclusions of mica scales and needles of tourmaline, the former by other cases where the quartz contains acicular rutile, lamellæ of chlorite, and crystals of epidote and siderite. Besides the large masses and crystals, it occurs also in crystals of ordinary sizes, and presents colored varieties—amethystine, smoky, and yellow (false topaz). Some of the amethysts are very rich in color, and might be available for gem use equally with those of Brazil and Siberia. These occur both in the granites and schists and in the volcanic rocks; and there are also many varieties of chalcedony, onyx, and jasper, some of which may be valuable for ornamental uses.

PRODUCTION.

In the following table is given a statement of the production of precious stones in the United States from 1896 to 1901:

Production of precious stones in the United States from 1896 to 1901.

Stone.	1896.	1897.	1898.	1899.	1900.	1901.
Diamond	None.	None.	None.	$300	$150	$100
Sapphire	$10,000	$25,000	$55,000	68,000	75,000	90,000
Ruby	1,000	None.	2,000	3,000	3,000	500
Topaz	200	None.	100	None.	None.	None.
Beryl (aquamarine, etc.)	700	1,500	2,200	4,000	11,000	5,000
Emerald	None.	25	50	50	4,000	1,000
Phenacite	None.	None.	None.	None.	None.	None.
Tourmaline	3,000	9,125	4,000	2,000	2,500	15,000
Peridot	500	500	500	500	500	500
Quartz, crystal	7,000	12,000	17,000	12,000	10,000	10,000
Smoky quartz	2,500	1,000	1,000	None.	1,000	1,000
Rose quartz	500	None.	100	100	100	150
Amethyst	500	200	250	250	500	500
Prase	100	None.	None.	None.	None.	None.
Gold quartz	10,000	5,000	5,000	500	2,000	2,000
Rutilated quartz	500	None.	100	50	50	50
Dumortierite in quartz	50	None.	None.	None.	None.	None.
Tourmalinated quartz	None.	None.	None.	None.	None.	1,000
Agate	1,000	1,000	1,000	1,000	1,000	1,000
Moss Agate	1,000	1,000	1,000	1,000	1,000	500
Chrysoprase	600	None.	100	100	100	1,500
Silicified wood (silicified and opalized	4,000	2,000	2,000	3,000	6,000	7,000
Opal	200	200	200	None.	None.	None.
Garnet (almandite)	500	7,000	5,000	5,000	500	100
Rhodolite	None.	None.	None.	None.	20,000	21,000
Garnet (pyrope)	2,000	2,000	2,000	2,000	1,000	1,000
Topazolite	100	None.	None.	None.	None.	None.
Amazon stone	1,000	500	500	250	250	200
Oligoclase	500	25	10	20	20	None.
Moonstone	250	None.	None.	None.	None.	None.
Turquoise	40,000	55,000	50,000	72,000	82,000	118,000
Utahlite (compact variscite)	500	100	100	100	100	250
Chlorastrolite	500	500	5,000	3,000	3,000	3,000
Mesolite (thomsonite, so called)	500	500	1,000	1,000	1,000	1,000
Prehnite	100	100	100	50	50	None.
Diopside	200	100	None.	None.	None.	None.
Epidote	250	None.	None.	None.	None.	None.
Pyrite	1,000	1,000	1,000	1,000	2,000	3,000
Malachite	None.	None.	None.	250	200	100
Rutile	100	800	110	200	100	None.
Anthracite	2,000	1,000	1,000	2,000	2,000	2,000
Catlinite (pipestone)	3,000	2,000	2,000	2,000	2,000	2,000
Fossil coral	1,000	500	500	50	50	100
Arrow points	1,000	1,000	1,000	1,000	1,000	500
Total	97,850	130,675	160,920	185,770	233,170	289,050

IMPORTS.

The following table shows the value of the diamonds and other precious stones imported into the United States from 1867 to 1901:

Diamonds and other precious stones imported and entered for consumption in the United States, 1867 to 1901, inclusive.

Year ending—	Diamonds.					Diamonds and other stones not set.	Set in gold or other metal.	Total.
	Glaziers'.	Dust.	Rough or uncut.	Set.	Unset.			
June 30—								
1867	$906	....	....	....	....	$1,317,420	$291	$1,318,617
1868	484	....	....	....	....	1,060,544	1,465	1,062,493
1869	445	$140	....	....	....	1,997,282	23	1,997,890
1870	9,372	71	....	....	....	1,768,324	1,504	1,779,271
1871	976	17	....	....	....	2,349,482	256	2,350,731
1872	2,386	89,707	....	....	....	2,939,155	2,400	3,033,648
1873	....	40,424	$176,426	....	....	2,917,216	326	3,134,392
1874	....	68,621	144,629	....	....	2,158,172	114	2,371,536
1875	....	32,518	211,920	....	....	3,234,319	....	3,478,757
1876	....	20,678	186,404	....	....	2,409,516	45	2,616,643
1877	....	45,264	78,033	....	....	2,110,215	1,734	2,235,246
1878	....	36,409	63,270	....	....	2,970,469	1,025	3,071,173
1879	....	18,889	104,158	....	....	3,841,335	538	3,964,920
1880	....	49,360	129,207	....	....	6,690,912	765	6,870,244
1881	....	51,409	233,596	....	....	8,320,315	1,307	8,606,627
1882	....	92,853	449,513	....	....	8,377,200	3,205	8,922,771
1883	....	82,628	413,996	....	....	7,598,176	[g]2,081	8,126,881
1884	22,208	37,121	367,816	....	....	8,712,315	....	9,139,460
1885	11,526	30,426	371,679	....	....	5,628,916	....	6,042,547
Dec. 31—								
1886	8,949	32,316	302,822	....	....	7,915,660	....	8,259,747
1887	9,027	33,498	262,357	....	....	10,526,998	....	10,831,880
1888	10,025	29,127	244,876	....	....	10,223,630	....	10,507,658
1889	8,156	68,746	196,294	....	....	11,704,808	....	11,978,004
1890	147,227	179,154	349,915	....	....	[e]12,429,395	....	13,105,691
1891	[a]565,623	125,688	(c)	....	....	[f]12,065,277	....	12,756,588
1892	532,246	144,487	....	....	....	[f]13,845,118	....	14,521,851
1893	357,939	74,255	....	....	....	[f]9,765,311	....	10,197,505
1894	82,081	53,691	....	....	....	[f]7,291,342	....	7,427,114
1895	107,463	135,558	....	....	....	[f]6,330,834	....	6,573,855
1896	78,990	65,690	....	(d)	(d)	[f]4,474,311	....	4,618,991
1897	[b]29,576	167,118	1,386,726	$330	$2,789,924	1,903,055	....	6,276,729
1898	8,058	240,665	2,513,800	6,622	5,743,026	1,650,770	....	10,162,941
1899	2,428	618,354	4,896,324	13,388	8,795,541	2,882,496	....	17,208,531
1900	8,333	605,495	3,658,645	10,721	7,803,066	1,472,328	....	13,558,588
1901	5,864	831,984	6,592,469	2,654	13,544,326	1,838,055	....	22,815,352

[a] Including also engravers', not set, and jewels to be used in the manufacture of watches, from 1891 to 1894; from 1894 to 1896 miners' diamonds are also included.

[b] Including also miners' and engravers' not set.

[c] Included with diamonds and other stones from 1891 to 1896.

[d] Not specified prior to 1897.

[e] Includes stones set and not specially provided for since 1890.

[f] Including rough or uncut diamonds.

[g] Not specified since 1883.

TALC AND SOAPSTONE.

By Joseph Hyde Pratt.

OCCURRENCE.

In the report for 1900 an extended description was given of the occurrence of talc throughout the United States, and during 1901 no new localities have been developed, although some promising prospects have been discovered. Talc is a very common mineral, and in small quantities it is widely distributed. It is found in considerable variety in nearly every State along the Atlantic slope, the deposits of best quality being in New York and North Carolina. That obtained from New York is used almost exclusively as a filler in the manufacture of paper, and most of that from North Carolina is ground to a powder and used in the manufacture of toilet powders; a little is used in paper manufacturing, etc., and a small amount is cut into pencils of various shapes and sizes, and into gas tips. There was but little change in the talc fields of New York, but in North Carolina the Hillyer mine, which had been idle for a number of years, was reopened and produced considerable talc during 1901.

The talc that is mined for manufacturing into washtubs, laboratory sinks, stove bricks, etc., is obtained for the most part from Virginia. The other States that have produced talc or soapstone are New Hampshire, Vermont, Massachusetts, New Jersey, Pennsylvania, Maryland, Georgia, and California. A large part of the soapstone mined in these latter States is ground, and is used for various purposes, as paint, paper filling, lubricants, etc.

The talc deposits of New York are in Edwards and Fowler townships of St. Lawrence County, and occur in a belt of impure limestone, which crosses a portion of these townships for a distance of 7 or 8 miles. The principal mines are located near Talcville, Edwards Township, and near Little York, Fowler Township. There has been a consolidation of a number of the smaller properties, so that they are now worked more systematically and on a larger scale.

In North Carolina the talc deposits are found in Swain and Cherokee counties, lying for the most part between a strata of marble and quartzite. The principal mining is in the vicinity of Hewitts and

Nantahala, Swain County, and a few miles east of Murphy, and in the vicinity of Kinsey, Cherokee County. The reopening of the Hillyer mine, which is about a mile east of Kinsey, has added considerably to the production of North Carolina talc. The mines in the vicinity of Hewitts have been worked on a much larger scale than for many years.

The pyrophyllite deposits of Moore County are extensively mined, the product being used for various purposes; but it is not of as good quality as the genuine talc, and does not command as high a price. There was a considerable increase in the production of the mines of this county over that of 1900, but there will always be a limited demand for the product, as it can not be used for the same purposes for which the finer grades of talc are adapted. There should be a large demand for it for foundry purposes.

The Massachusetts talc deposits are located near Dalton, Berkshire County, and are worked by drifting and shafting. One tunnel has been run in 200 feet, starting on the north side of the slope, at the end of which a shaft 80 feet deep has been sunk. The width of the deposit upon which the work has been done is 28 feet. The talc is foliated, and all that is mined is ground to a flour talc.

In Warren County, N. J., a soapstone vein has been encountered which has a northeast-southwest strike. It is worked by the Lizzie Clay and Pulpstone Company, which has an open quarry on the bank of the Delaware River about 20 feet above the water. This deposit has been worked almost continuously for twenty years, and there have been over 50,000 tons of talc taken out, nearly all of which has been ground to a powder, the larger proportion being used in the manufacture of paper. The tailings from the bolting of the ground talc are used to some considerable extent by roofing-paper manufacturers and others. This same vein of talc outcrops across the river on the Pennsylvania side, in the vicinity of Easton, Northampton County, and is worked extensively. The general width of the soapstone belt is from 500 to 600 feet, and it is associated with limestone. Practically all of this Pennsylvania and New Jersey talc or soapstone, which is almost identical in appearance and quality, is put on the market in the form of a ground product.

Talc deposits have been worked in Maryland by H. A. Weldy, in Howard County. Near Westminster, Carroll County, soapstone deposits are reported, which contain fine stone that is capable of being mined in large blocks, and is also of sufficient purity for grinding. A small amount of this soapstone was ground during the last year. These deposits are owned by Thomas & Son, of Westminster. The Virginia deposits are, for the most part, the steatite variety of talc, some of which is ground to flour talc. Most of it, however, is used for manufacturing into washtubs, etc. A considerable quantity of this soapstone was formerly used in the manufacture of slate pencils, but there is now but little used for this purpose. B. H. Hester, of Oakland, Louisa County, reports the occurrence of a deposit of soapstone of very good quality in that section. In the vicinity of Wiehle, Fairfax County, a fibrous talc has been obtained in some quantity.

The occurrence of talc in Georgia is somewhat similar to that of North Carolina, and the formation is probably a continuation of it, but the talc is more compact and is not of so fine a quality. The principal mining has been done in Murray County, 2 miles east of Dalton. A deposit of white talc is reported 2 miles from Ballground, Ga., which has been prospected to some extent by open cuts, shafts, and borings. It is expected that this deposit will be worked during 1902. The width of the deposit is from 4 to 6 feet. About one-half of the talc mined in Georgia is put on the market in the form of ground talc.

Soapstone is found at Catalina Island, Los Angeles County, Cal., a portion of which is suitable for grinding, while another portion is much harder and resembles serpentine. In Tulare County, near Lindsay, about 2½ miles east of the railroad, lenses of talc 6 to 8 feet wide have been recently discovered a hundred or more feet in length. The talc formation can be traced for a distance of 1,500 feet.

There is a constantly increasing demand for talc, especially for that suitable for grinding to powder for use for complexion powders and for paper filling, and any new occurrence of this mineral in quantity and near railroad transportation is worthy of investigation.

USES.

Talc is employed in the arts in two distinct forms—as powdered or flour talc and as sawed pieces of various sizes and shapes. The flour talc is used as a base for fireproof paints, for electric insulators, in boiler and steam-pipe coverings, for foundry facings, in the manufacture of dynamite, in the manufacture of wall papers to give them a glossy appearance (ground mica being the mineral most extensively used for this purpose), in the manufacture of various toilet powders, for dressing skins and leather, and as a base for lubricants and for many of the cheaper soaps. Nearly all of the fibrous talc produced in St. Lawrence County, N. Y., is ground and used in the manufacture of paper. Its fibrous and pliable character makes it valuable for this purpose, as it causes the talc to be retained in the paper pulp, thus giving the paper additional strength as well as weight. Some of the flour talc made from the nonfibrous mineral is sometimes used in paper manufacturing, but although this acts satifactorily as fillers, it does not strengthen the paper.

Some of the pure compact varieties of steatite that are entirely free from grit have been ground to flour talc and used for many of the purposes enumerated above. The larger portion of the soapstone (steatite) mined is used in the manufacture of hearthstones, as linings for furnaces, for cupola and converter linings in many steel works, for laboratory tables and ovens, for laundry tubs and slate pencils, and to a limited extent in building. It is extensively used in the manufacture of soapstone griddles, which have been found very satisfactory, as they can be used without grease; also in the manufacture of foot warmers, as the soapstone will retain its heat for many hours; as boot driers, and for many other articles of everyday use.

The compact varieties of the pure talc are used in the manufacture of pencils of all shapes and sizes, and of coal and acetylene gas tips. The talc that is suitable for manufacturing into these pencils brings the highest price of any talc produced in the country, and by far the greater part is obtained from Swain County, N. C.

PRODUCTION.

The production of talc in the United States in 1901, exclusive of the fibrous talc that is obtained from New York, was 28,643 short tons, valued at $424,888, as compared with 27,943 tons, valued at $383,541, in 1900. This is an increase of 700 tons in amount and of $41,347 in value, and is due, at least in part, to the larger production of manufactured articles from the Virginia soapstone. There was a decided falling off in the amount of talc sawed into slabs.

Nearly all of the talc that is mined is used by the original producers, there being but a small amount sold in the crude state. The talc is classified according to the manner in which it is marketed, as rough, sawed into slabs, manufactured articles, and ground talc. There is always in the manufactured articles a considerable variation each year in the value of the production, which is undoubtedly due to the character of the article made.

In the following table the production of talc and soapstone and the value in the condition in which it was sold are given for the years 1893 to 1901:

Production of talc and soapstone from 1893 to 1901, inclusive.

Condition in which marketed.	1893.		1894.		1895.		1896.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Short tons.		*Short tons.*		*Short tons.*		*Short tons.*	
Rough	5,760	$51,600	5,620	$50,780	1,041	$8,886	1,550	$13,375
Sawed into slabs	101	4,400	1,303	19,500	863	12,320	923	15,481
Manufactured articles[a]	7,070	123,600	6,425	241,000	10,789	170,791	10,133	232,261
Ground[b]	8,137	75,467	9,796	87,045	8,802	74,498	9,577	92,948
Total[c]	21,071	255,067	23,144	401,325	21,495	266,495	22,183	354,065

[a] Includes bath and laundry tubs; fire brick for stoves, heaters, etc.; hearthstones, mantels, sinks, griddles, slate pencils, tailors' pencils, gas tips, and numerous other articles of everyday use.

[b] For foundry facings, paper making, lubricators, dressing skins and leather, etc

[c] Exclusive of the amount used for pigment, which is included among mineral paints.

Production of talc and soapstone from 1893 to 1901—Continued.

Condition in which marketed.	1897.		1898.		1899.		1900.		1901.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Short tons.		*Short tons.*		*Short tons.*		*Short tons.*		*Short tons.*	
Rough	1,020	$12,535	1,380	$16,453	1,540	$18,800	3,086	$32,458	3,920	$30,874
Sawed into slabs	1,107	21,726	1,305	13,240	1,499	12,392	1,065	19,520	225	4,261
Manufactured articles[a]	12,095	267,583	11,336	191,923	12,377	[b]229,310	10,551	174,270	12,618	257,146
Ground[c]	7,701	63,785	8,210	65,496	9,349	70,303	13,241	157,293	11,880	132,607
Total[d]	21,923	365,629	22,231	287,112	24,765	330,805	27,943	383,541	28,643	424,888

[a] Includes bath and laundry tubs; fire brick for stoves, heaters, etc.; hearthstones, mantels, sinks, griddles, slate pencils, tailors' pencils, gas tips, and numerous other articles of everyday use.

[b] Includes manufactured materials to the value of $40,275, for which no quantities were given.

[c] For foundry facings, paper making, lubricators, dressing skins and leather, etc.

[d] Exclusive of the amount used for pigment, which is included among mineral paints.

A considerable quantity of the North Carolina talc was sold crude, but was afterwards ground and used in the manufacture of paper. Almost the entire production from New Jersey is also used for this same purpose. The larger amount of the Virginia soapstone is put on the market in the form of manufactured articles.

The production by States since 1898 is as follows:

Production of talc and soapstone in 1898, 1899, 1900, and 1901, by States.

State.	1898.		1899.		1900.		1901.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Short tons.		*Short tons.*		*Short tons.*		*Short tons.*	
Georgia	639	$4,054	1,062	[a]$42,085	6,477	$77,213	693	$4,717
North Carolina	1,695	27,320	1,817	31,880	4,522	75,308	5,819	77,824
Pennsylvania	3,778	25,436	5,012	32,872	....	....	2,552	19,132
Virginia	10,059	119,480	10,886	107,062	9,806	116 930	12,511	232,900
Other States[b]	6,060	110,822	5,988	[c]116,906	7,138	114,090	7,068	90,315
Total	22,231	287,112	24,765	330,805	27,943	383,541	28,643	424,888

[a] Includes manufactured articles to the value of $36,000, for which no quantities were given.

[b] California, Maryland, Massachusetts, New Hampshire, New Jersey, and Vermont; also Pennsylvania in 1900.

[c] Includes $40,275 value, for which no quantity was reported.

As is seen from the above table, there has been a decided increase in the production of both North Carolina and Virginia in 1901, while the production of Georgia is hardly one-tenth of what it was in 1900. The large increase in value of the Virginia production is due to the amount of manufactured articles that were made. The apparently small increase in value of the North Carolina production is partially due to the large production of pyrophyllite soapstone from Moore County, which does not command as high a value as the genuine talc.

The amount and value of talc and soapstone produced in the United States since 1880, exclusive of that used as a mineral pigment and of the fibrous talc from New York, is given in the following table:

Annual product of talc and soapstone since 1880.

Year.	Quantity.	Value.	Year.	Quantity.	Value.
	Short tons.			*Short tons.*	
1880	8,441	$66,665	1891	16,514	$243,981
1881	7,000	75,000	1892	23,908	437,449
1882	6,000	90,000	1893	21,071	255,067
1883	8,000	150,000	1894	23,144	401,325
1884	10,000	200,000	1895	21,495	266,495
1885	10,000	200,000	1896	22,183	354,065
1886	12,000	225,000	1897	21,923	365,629
1887	12,000	225,000	1898	22,231	287,112
1888	15,000	250,000	1899	24,765	330,805
1889	12,715	231,708	1900	27,943	383,541
1890	13,670	252,309	1901	28,643	424,888

PRODUCTION OF FIBROUS TALC IN NEW YORK.

As the production of talc in St. Lawrence County, N. Y., is usually more than double that of all the other States together, although the value is nearly the same, and as it is used principally for the one particular purpose of paper making (due to its fibrous character), its production is taken up separately. The production in 1901 was 69,200 tons, valued at $483,600, which is an increase of 5,700 tons in amount, but a decrease of $15,900 in value, as compared with a production of 63,500 tons, valued at $499,500, in 1900.

The production of fibrous talc in the United States since 1896 is shown in the following table:

Disposition of fibrous talc produced since 1896.

Uses.	1896.		1897.		1898.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Short tons.		*Short tons.*		*Short tons.*	
Sold crude	1,363	$2,726	9,800	$21,500	500	$1,250
Paper filling	44,726	396,717	47,209	375,436	53.856	410,180
Paint						
Wall plasters						
Total	46,089	399,443	57,009	396,936	54,356	411,430

Uses.	1899.		1900.		1901.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Short tons		*Short tons.*		*Short tons.*	
Sold crude	500	$1,250	....	....	200	$600
Paper filling	51,155	436,900	63,500	$499,500	69,000	483,000
Paint						
Wall plasters						
Total	51,655	438,150	63,500	499,500	69,200	483,600

During the last year or two there has been a consolidation of a number of the smaller properties, which will probably result in a larger production of fibrous talc in 1902.

The increase in the use of fibrous talc in the paper industry, as this is the purpose for which nearly all the New York talc is used, is well illustrated in the following table, which shows the production of this variety of talc since 1880:

Production of fibrous talc since 1880.

Year.	Quantity.	Value.	Year.	Quantity.	Value.
	Short tons.			*Short tons.*	
1880	4,210	$54,730	1891	53,054	$493,068
1881	5,000	60,000	1892	41,925	472,485
1882	6,000	75,000	1893	35,861	403,436
1883	6,000	75,000	1894	39,906	435,060
1884	10,000	110,000	1895	39,240	370,897
1885	10,000	110,000	1896	46,089	399,443
1886	12,000	125,000	1897	57,009	396,936
1887	15,000	160,000	1898	54,356	411,430
1888	20,000	210,000	1899	54,655	438,150
1889	23,746	244,170	1900	63,500	499,500
1890	41,354	389,196	1901	69,200	483,600

IMPORTS.

At the present time but little talc is imported into the United States. From 1880 to 1889 the imports were fairly regular, but since 1889 they have been very irregular, owing undoubtedly to the development of good deposits of this mineral in this country. The imports were mainly of French and Italian talc, which have been quoted on the market at a higher price than any mined in the United States, although the quality is probably not any better than that from Swain and Cherokee counties, N. C. This variation in the amount of talc imported is shown in the following table, which gives the value of the talc imported from 1880 to 1887, and the quantity and value of that imported from 1888 to 1901:

Talc imported into the United States from 1880 to 1901, inclusive.

Year.	Quantity.[a]	Value.	Year.	Quantity.	Value.
	Short tons.			*Short tons.*	
1880		$22,807	1891	81	$1,121
1881		7,331	1892	531	5,546
1882		25,641	1893	1,360	12,825
1883		14,607	1894	622	6,815
1884		41,165	1895	3,165	26,843
1885		24,356	1896	1,966	18,693
1886		24,514	1897	796	8,423
1887		49,250	1898	761	9,338
1888	24,165	22,446	1899	254	3,544
1889	19,229	30,993	1900	79	1,070
1890	1,044	1,560	1901	2,386	27,015

[a] Quantity not reported previous to 1888.

CANADIAN PRODUCTION.

In the following table is shown the output of soapstone in Canada for a period of sixteen years. It will be observed that the values are usually much less than those given for the United States product, and the fluctuations in value are even more pronounced than in this country.

Production of soapstone in Canada from 1886 to 1901, inclusive.

Year.	Quantity.	Value.
	Short tons.	
1886	50	$400
1887	100	800
1888	140	280
1889	195	1,170
1890	917	1,239
1891	None.	....
1892	1,374	6,240
1893	717	1,920
1894	916	$1,640
1895	475	2,138
1896	410	1,230
1897	157	350
1898	None.	....
1899	450	1,960
1900	420	1,365
1901	None.	....

ABRASIVE MATERIALS.

By Joseph Hyde Pratt.

INTRODUCTION.

The abrasive materials are as a whole but little understood, although they are in one sense among the most important of the mineral products. The principal abrasives can readily be divided into three general groups:

1. Those which occur as rock formations and are cut and manufactured directly into the form desired, while retaining their original rock structure and appearance, as grindstones, whetstones, etc.
2. Those which occur as a constituent of either a rock or a vein, and have to be mechanically separated from the associated gangue and cleaned, as corundum, emery, and garnet.
3. Artificial abrasives, as carborundum, crushed steel, and artificial corundum.

The abrasives included in the above groups are treated under the following heads: Oilstones and whetstones, grindstones and pulpstones, buhrstones and millstones, pumice, infusorial earth and tripoli, crystalline quartz, garnet, corundum and emery, carborundum, crushed steel, and artificial corundum.

While the production of certain of these abrasives is on the decline, that of others is increasing, and the aggregate amount of abrasive materials used is greater than ever before. This is due to the increase in our manufacturing industries. Their use, of course, is limited, and there could readily be an overproduction of most of them; but there will be an increasing demand for them from year to year, which will depend principally upon the growth of manufacturing industries, and with an increase or a decrease in these industries there will be a corresponding change in the production of the abrasives. There will be noticeable changes in the amount of the different kinds of abrasives used from year to year, some increasing rapidly and some steadily decreasing, these variations being due to the introduction of new natural or artificial products. To what extent the artificial abrasives will replace the natural ones can not now be stated, for no appreciable change that is due to the introduction of the artificial can now be noticed in the production of these natural abrasives, and no change may be observed for some years to come.

The total value of all the natural abrasives produced in the United States during 1901 was $1,194,772, as compared with $1,208,073 for 1900. In the following table is given a list of the values of production of the different abrasives in the United States for the years 1900 and 1901:

Value of abrasives produced in United States during 1900 and 1901.

Kind of abrasive.	Value.		Kind of abrasive.	Value.	
	1900.	1901.		1900.	1901.
Oilstones and scythestones..	$174,087	$158,300	Crystalline quartz	$40,705	$41,500
Grindstones	710,026	580,703	Garnet	123,475	158,100
Buhrstones and millstones..	32,858	57,179	Corundum and emery	102,715	146,040
Infusorial earth and tripoli.	24,207	52,950	Total	1,208,073	1,194,772

Artificial abrasives produced in United States during 1900 and 1901.

Kind of abrasive.	1900.	1901.	Kind of abrasive.	1900.	1901.
	Pounds.	*Pounds.*		*Pounds.*	*Pounds.*
Carborundum	2,401,000	3,838,175	Crushed steel	700,000	690,000

OILSTONES, WHETSTONES, ETC.

The term oilstone is a little ambiguous in meaning and is a word that has come to be applied to all stones used for sharpening mechanics' tools, for the reason that it is necessary to use oil on most of them to prevent the stone from becoming hot and thus heating the tool and also to prevent the small particles of steel that are ground off from the tool from entering into the pores of the stone. Thus it is that the same stone when used for one purpose will be called an oilstone and when used for another will be called a whetstone, or perhaps a scythestone.

SOURCES AND KINDS OF WHETSTONE-PRODUCING ROCKS.

The materials from which these stones are made are very variable, but are of sedimentary origin, and include quartz-mica-schist, sandstone, novaculite, and the intermediate stones. These are found abundantly in various localities, so that there is probably no country, or at any rate but few countries, which have not within their borders a supply of some kind of stone suitable for making whetstones. Although the material for manufacturing whetstones is so common, only those quarries which produce stones of superior quality and have the greatest advantages for manufacture and for shipment can survive competition in the trade. This is the reason the supply of whetstones is confined to a few localities. Where, however, the stone is of exceptional quality, as the novaculites of Arkansas, there is a large demand for them both at home and abroad, although their price may be higher than that of other whetstones.

In the United States rocks suitable for making whetstones are found in nearly all the States east of the Mississippi and in a number of those to the west of that river; but the supply is obtained from a few of them, namely, Arkansas, Indiana, Ohio, New York, Vermont, and New Hampshire. As there are a number of different rocks from which whetstones are manufactured, it is a natural consequence that the stones themselves should be varied and should be used for many different kinds of grinding, as in the case of grindstones. Not only the variation in the kind of rock used, but also the variation in the size and character of the grit in the rock, causes a change in the character and quality of the whetstone. In order better to understand the variations in the whetstones, some idea must be had of the kind of rocks from which they are made, and for this reason the rocks are described below.

Sandstones.—Under this head are included a number of rocks, as pure sandstone, micaceous sandstone, and the peculiar sandstone known as novaculite. Of these three varieties the novaculite is by far the most important, as from it are made the most celebrated oilstones.

The pure sandstones from which whetstones are made are the same rock formations that occur in Ohio, known as the Berea grit, from which grindstones are made, as described fully under "Grindstones." As a rule, whetstones made from this sandstone can be used only for coarse grinding, on account of the size of the grains of quartz. The main exceptions to the above are the sandstone found at Euclid, Ohio, and known as Euclid grit, which furnishes a very fine-grained oilstone, and another sandstone at Chagrin Falls. When there is any earthy or mineral matter present in these rocks it will, if in small amount, add solidity to the stone and assist in producing a finer edge than the grit alone would give. On the other hand, if there is very much of the earthy material present it will interfere with the abrasive efficiency of the grains of quartz and be injurious to the stone.

Sometimes there is present in the sandstone a considerable percentage of mica; and these might well be called mica-sandstones. Rocks of this character have been utilized for the manufacture of whetstones, but at the present time none of these are used.

Novaculite is the name given to an exceptional sandstone rock that is extensively developed in Arkansas.[a] While at first this rock was supposed to be allied to the cherts, which are cryptocrystalline siliceous rocks formed by chemical action and containing a large percentage of silica principally in the form of chalcedony, chemical analyses and microscopic examination have shown that it is a pure siliceous rock made up of finely fragmental quartz grains. Novaculite does not contain any silica in the form of chalcedony, and has a fine gritty feeling, while the chert is more glassy, although both are tough rocks and break with a conchoidal fracture. The quartz in the novaculite is in minute irregular grains having an average diameter of less than .01 millimeter, which are closely crowded together, forming a dense groundmass. Here and there are little cavities which appear on first sight to be irregular in outline but are really rhombic, indicating that calcite (carbonate of lime) was formerly present in the rock but has been leached out. The cavities are small, averaging about .05 millimeter in diameter, and are occasionally observed to be filled with secondary silica. The novaculite deposits occur in Arkansas as a stratified formation, whose common thickness is 500 to 600 feet, including some flinty shales and sandstones. The novaculites proper, which are the prominent members of this formation, occur in beds from a few inches to 12 or 15 feet in thickness. The strata are found commonly in a nearly vertical rather than in a horizontal position. The movements that have caused this change in the strata have, in some cases, had a tendency to crush certain portions of the brittle novaculite into fragments, and in others to form only planes of cleavage. These joint planes form systems of parallel planes dipping at all angles, and they are apt to be found at almost any point in the novaculite formation, as many as six systems having been observed in a single quarry. They are apt to prevent the obtaining of large blocks of good novaculite. Sometimes they are only a fraction of an inch apart, thus completely breaking up the blocks into small pieces by the intersection of several sets of planes. Conchoidal planes of fracture sometimes exist, which have apparently been developed by the same pressure that produced the other planes, and although they are not evident when the stone is first taken out, they render it liable to fracture. Thus stones containing them can not be considered sound, although the grit in them may be of the first quality. Another obstacle in quarrying novaculite is the cracking and breaking of the stone, due to the freezing of the water that it has absorbed. The stone has been known to break in cold weather while being manufactured, from the freezing of the water absorbed by the novaculite during the sawing process. There are often hard spots and cracks that have to be avoided in obtaining good stone, and also fine quartz veins which intersect the rock in great numbers. Many of these veins of quartz are so thin that they can hardly be distinguished by the eye, yet they would render a finished stone worthless, as they would nick a tool while grinding. As a rule these veins lie along joint planes, so that their extent can often be determined. As they do not show at the surface, frequently they are not found until the stone has been sawed, which usually means a large loss of stone. Still again, the novaculite may be injured by the presence of small cavities called "sand hills," which vary in size from that of a pin head or smaller to over an inch in diameter. These "sand hills" should not be confounded with the microscopic rhombohedral cavities to which reference has previously been made.

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[a] Novaculites, by L. S. Griswold: Ann. Rept. Geol. Survey Arkansas, Vol. III, 1890.

Mica-schists.—The rocks of this class that are of value for the manufacture of whetstones are those that contain a considerable percentage of grit, usually in the form of grains of quartz. The mica-schists are finely laminated metamorphic rocks that are the result of the thorough metamorphism or recrystallization of sandstones, shales, and clays. They are also formed by the crushing and excessive shearing of igneous rocks. In many localities a quartz-schist is found in which the grains of quartz are evenly arranged, giving to the rock a uniformity of structure which adapts it to the manufacture of a whetstone. These schists vary in color and in hardness with the percentage of quartz. They are often of an argillitic or slaty structure, and some of them may have been derived from slates. The grit of the schist is not so sharp as that of the sandstones, because in the schist there is a great deal of soft material besides the grains of quartz, which would prevent them from abrading freely, and the grains of quartz are also apt to be more lenticular than those in the sandstones. These schists make a strong stone that wears away rapidly and is used very largely in the production of scythestones. While quartz is the material that usually gives the abrasive power to the schist, occasionally this is due to microscopic garnets, as in the Belgian stones.

WHETSTONE LOCALITIES.

Arkansas.—The Arkansas whetstone quarries are located in Garland and Saline counties, the principal ones being on Quarry or Whetstone Mountain, near Hot Springs, Garland County. Griswold, in his report on the novaculite areas of Arkansas,[a] shows that the novaculite deposits are extensive, but only one new quarry of any importance has been opened since that report was published. This quarry is located in Saline County, near Brazils post-office. The reasons for this scarcity of quarries are perhaps indicated by what has been said above regarding the difficulties encountered in quarrying and manufacturing the stone. The quality of the rock varies greatly in different parts of the same quarry, but two distinct types of stone, known as the Arkansas and Washita (formerly spelled Ouachita), are obtained. The Arkansas stone is a true novaculite, and an average analysis shows it to contain 99.5 per cent of silica. There are two grades of the stone, known as hard and soft Arkansas, which are described in detail in the report for 1899.[a] The difference between the two is that the soft Arkansas stone is more porous, and hence does not impart quite so fine an edge as the other. It is used principally in the form of small wheels, oilstones of different shapes, and points such as are used by engravers, surgeons, carvers, dentists, jewelers, watchmakers, die sinkers, etc. It is the best stone manufactured for all who use small-pointed or very fine-edged tools.

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[a] Ann. Rept. Geol. Survey Arkansas, Vol. III, 1890, p. 224.

The Washita stone is in all its physical characteristics very similar to the Arkansas, but is less dense and much more porous, this porosity being due to the abundance of the rhombic cavities in the stone. It does not have so waxy a luster as the Arkansas stone, but has more of the appearance of glazed china ware. There are two grades of the Washita stone, known as hard and soft.[b]

Indiana.—The sandstones of Orange County, Ind., furnish a whetstone known as the Hindostan or Orange stone, which is quarried in Frenchlick and Northwest townships. The stone is fine grained and is used for an oilstone. It is considered the best low-priced sharpening stone for mechanics' tools. A considerable quantity of this stone is now being exported.

Kentucky.—The Caron Stone Company is quarrying to a limited extent a water hone from Hardin County, Ky. It is claimed that when heated this stone makes a good oilstone.

Ohio.—At a number of the quarries in the Berea sandstone a grade of stone is obtained that is suitable for making whetstones, principally at Berea, in Cuyahoga County, and at Grafton, in Lorain County. This makes a scythestone that does good work, but it does not stand transportation so well as the scythestones made from schist. At Euclid, Cuyahoga County, is a fine-grained sandstone from which a considerable number of oilstones are made, and which will be described under the heading "Grindstones." The well-known Deerlick oilstone is made at Chagrin Falls, in the same county, from a fine-grained sandstone, and since the introduction of this stone, a few years ago, its production has increased considerably each year.

New York.—In Cortland County, near Labrador Lake, a sandstone similar to that quarried in Ohio is found. It is known as Labrador stone, and is used to a limited extent in the manufacture of whetstones.

New Hampshire and Vermont.—In Haverhill Township, Grafton County, N. H., and near Lamoille, Orleans County, Vt., there is a quartz-mica-schist from which are manufactured the celebrated Indian Pond, White Mountain, and Lamoille scythestones. These schists are variable in their structure, so that only portions or bands of them can be utilized. In these bands, however, which are usually homogeneous, there is little waste material except that which is lost in splitting and breaking the stone for the rubbing tables. The cutting quality of the stones varies with the compactness of the schists and the percentage of quartz or grit contained. There are two principal grades of stone found at the New Hampshire quarries, which are known as the Indian Pond and the White Mountain. The name Indian Pond was used as early as 1820 for a stone obtained from a stratum of schist about 7 miles south of Pike Station, near a pond known by the above name. Both of these stones come from the same quarry. The White Mountain is more compact and has a finer texture, and the Indian Pond includes the more laminated varieties of the schist. The main quarries from which these stones are obtained are near Pike Station, where the home office and principal manufacturing plant are located. As the flat slabs of schist are taken from the quarry they are readily split up along the planes of lamination, and are then roughly broken into pieces about a foot square. These are then marked with a steel point, on each side, indicating sections that will give the desired width for the scythestones. A heavy knife blade is then placed on one of these marks and given a quick blow with a hammer, which readily breaks the squares into the desired width. A man can cut, on an average, about 3,000 stones a day. The best record for cutting is 5,300 in one day of ten hours. These rough-cut sticks of stone are taken to the rubbing mill, where they are ground down to the desired shape and size, and are then ready to be labeled and packed for shipment. The stones from the quarries at Lamoille are sold under the name of Lamoille stones. At Lisbon, Grafton County, N. H., there occurs a fine-grained quartz-mica-schist of a bluish chocolate color, which furnishes a stone known as the Chocolate whetstone. It is a medium hard stone and is especially adapted for leather and skinning knives, and is also used extensively for sharpening cloth cutters' tools, kitchen and carving knives, etc.

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[a] Twenty-first Ann. Rept. U. S. Geol. Survey, Part VI Cont., p. 474.

[b] Loc. cit., p. 475.

While the sale of oilstones and whetstones has either increased or held its own in the United States, there has been a considerable falling off in the sale of scythestones. This is undoubtedly due to the small use at the present time of scythes, sickles, etc., which have been almost entirely replaced by improved agricultural machines and implements; and scythestones are now used in quantity only in the border States or in those countries into which the improved agricultural machines have not yet been introduced. Thus it is that scythestones have been forced to seek a market in foreign countries, and now form the larger part of our exports of this kind of stone.

PRODUCTION.

During the last few years there has been a general increase in the production of oilstones and whetstones in the United States, though their value has declined since 1899. This has been partly due both to the successful introduction of the American stones into foreign markets and to the general growth in this country of the trades that use them. The year of maximum production was 1899, when the value of the output amounted to $208,283. There was a considerable falling off in the value of the production of 1901, which was $158,300.

In nearly all cases the producers of these abrasive materials for oilstones and whetstones are also the manufacturers, and for this reason the statistics of the production of these stones are for the finished product. There is but very little of the raw material sold. The value of the oilstones, whetstones, etc., produced from 1891 to 1901, inclusive, is given in the following table:

Value of oilstones, whetstones, etc., produced in the United States since 1891.

Year.	Value.	Year.	Value.
1891	$150,000	1897	$149,970
1892	146,730	1898	180,486
1893	135,173	1899	208,283
1894	136,873	1900	174,087
1895	155,881	1901	158,300
1896	127,098		

From 1880 to 1890, inclusive, the product and value of the rough stone have been published in these reports, except in the case of the output for 1890, when the value for the unfinished product was given for the novaculite of Arkansas, while in all other cases the value of the finished stones was given. The annual production from 1880 to 1890 was as follows:

Production of oilstones and whetstones from 1880 to 1890.

Year.	Quantity.	Value.	Year.	Quantity.	Value.
	Pounds.			*Pounds.*	
1880	420,000	$8,000	1886	1,160,000	$15,000
1881	500,000	8,580	1887	1,200,000	16,000
1882	600,000	10,000	1888	1,500,000	18,000
1883	600,000	10,000	1889	5,982,000	32,980
1884	800,000	12,000	1890	....	69,909
1885	1,000,000	15,000			

IMPORTS.

Oilstones and whetstones continue to be imported into the United States in about the same amount that they have been for the last few years. They consist principally of Belgian razor hones, that are made from a slaty mica-schist found in the Ardenne Mountains of Belgium; of razor hones made from a fine, hard, blue-green slaty mica-schist from Sonneberg, Germany; and of a small amount of "Turkey" oilstones from France and Italy.

The following table shows the total value of all kinds of hones, whetstones, etc., imported since 1880:

Imports of hones and whetstones since 1880.

Year ending—	Value.	Year ending—	Value.
June 30—		December 31—	
1880	$14,185	1891	$35,344
1881	16,631	1892	33,420
1882	27,882	1893	25,301
1883	30,178	1894	26,671
1884	26,513	1895	32,439
1885	21,434	1896	50,588
December 31—		1897	34,485
1886	21,141	1898	30,856
1887	24,093	1899	34,510
1888	30,676	1900	39,316
1889	27,400	1901	64,655
1890	37,454		

EXPORTS.

Oilstones and scythestones are also exported, the value of the exports being largely in excess of the imports. The exports consist principally of New Hampshire scythestones, which are shipped into nearly all foreign countries, but find their largest market in Europe. Indiana and Arkansas oilstones are also exported to some extent, with a growing demand for the latter. The amount of the exports of these stones will gradually increase, while there will be but little increase in the imports.

GRINDSTONES.

SOURCES AND KINDS OF MATERIAL USED.

The grindstones produced in the United States come almost entirely from Ohio and Michigan, and it is from the former State that the chief supply is obtained. As the principal source of the material from which the grindstones are manufactured is the sandstone that is found so extensively in the Lower Carboniferous series of Ohio, a brief description of this sandstone is given.

In the Lower Carboniferous series of Ohio there is a persistent bed, or series of beds, of sandstone which has been found to extend almost continuously from the northern part of West Virginia across the Ohio River northward through the central part of Ohio into Huron County, passing thence eastwardly to near the northeast corner of Trumbull County.[a] This sandstone is called the Berea grit,[b] on account of its having been so extensively quarried at Berea, in Cuyahoga County. The sandstone is found about 300 feet below the rocks of the Coal Measures. Above the Berea grit is the Berea shale, which is prevailingly dark to black, highly fossiliferous, and a constant and immediate cover of the Berea grit throughout its extent in Ohio. The lowest layer of this shale is sometimes composed of sand bound together by pyrite. It varies from 15 to 50 feet in thickness, and in nearly all cases where it has been encountered its boundaries are sharp and distinct, this being especially true in central and southern Ohio.

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[a] Geol. Survey Ohio, Vol. VI, 1888, p. 311.

[b] Mineral Resources U. S., 1882, p. 478.

Beneath the Berea grit is another argillaceous shale, which is known as the Bedford shale,[a] and which is uniformly from 70 to 75 feet in thickness. This shale is confined principally to northern Ohio, and its upper portion is generally of a marked red color, while the lower portion is a dark bluish gray. The thickness of these two shales is variable; sometimes they are nearly equal in thickness; at other times the red largely predominates; and at others the blue shale comes practically in contact with the Berea grit.[b]

The Berea grit, although varying considerably in thickness, from 40 to over 100 feet, and differing locally in character, is generally a rather fine-grained and homogeneous sandstone, which lies in courses varying from a few inches to several feet in thickness, and varies in color from a light drab to a light or steel blue. It is usually divided into two distinct parts, the upper of which is a series of thin beds which may be used for flagging, while the lower is more massive. In some places the division of these two parts is distinctly marked, while in others the whole mass is practically homogeneous. At still other places the upper part has been removed by glacial erosion, and the section exposed in the quarries consists chiefly of the massive sandstone.

As the Berea grit is traced eastward it becomes less massive, and in the eastern counties of Ohio the layers of sandstone are interlain by beds of shale. In the western part of Pennsylvania the Berea grit is hardly distinguishable, the whole mass there being made up of alternate beds of sandstone and shale. A similar change is observed as the Berea grit is followed southward, but in the vicinity of the Ohio River it is still marked by an unusual prevalence of sandy matter, and there are many good, though small, quarries in this section. This grit attains its maximum development in the northwestern portion of the area, as in Lorain County at Elyria and Amherst. In this county the sandstone reaches a thickness of 60 feet, and is more massive throughout than anywhere else within the limits of the State; and it is here that the greatest amount of quarrying has been done.

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[a] Geol. Survey Ohio, Vol. VI, 1888, p. 33.

[b] Geol. Survey Ohio, Vol. I, 1873, pp. 186, 209, Vol. II, 1874, pp. 88, 211; Vol. III, 1878, pp. 21, 301; Vol. VI, 1888, pp. 35, 311.

PRODUCTION.

The total value of the production of all kinds of grindstones in 1901 was $580,703, or $129,323 less than the production of 1900, which was $710,026, being higher than that of any previous year. The next highest value was reached in 1882, when it was $700,000. The value of the output in 1901 was nearly $100,000 less than that of 1899, which was $675,586. The tonnage was considerably greater in 1899, in 1900, and in 1901 than in 1882, for in the last-named year the price of the grindstones was $15 per ton, and during the last three years the price has been from $9 to $10 per ton. The decidedly marked increase in the production of grindstones during the last three years has been largely due to the prosperous condition of the country, resulting in a large increase in all kinds of manufacturing, and in part to the export trade that has started in grindstones. The manufacture of the large number of agricultural machines that are now being made is one of the main industries that have caused a large increase in the number of grindstones demanded, and they have caused a smaller demand for scythestones.

Some manufacturers, in making their reports of production to the Survey, use the ton as the unit of measurement, while others state the number of grindstones made and sold. In 1901 the manufacturers who stated the number of grindstones sold reported a product aggregating 40,948 pieces, valued at $396,238, as compared with 6,085 pieces, valued at $81,772, in 1900. The product reported by weight amounted to 16,807 tons, valued at $165,665, while in 1900 the amount was 46,406 tons, valued at $619,399.

In the following table is shown the value of grindstones, including pulpstones, produced in the United States since 1880:

Value of grindstones produced in the United States since 1880.

Year.	Value.	Year.	Value.
1880	$500,000	1891	$476,113
1881	500,000	1892	272,244
1882	700,000	1893	338,787
1883	600,000	1894	223,214
1884	570,000	1895	205,768
1885	500,000	1896	326,826
1886	250,000	1897	368,058
1887	224,400	1898	489,769
1888	281,800	1899	675,586
1889	439,587	1900	710,026
1890	450,000	1901	580,703

IMPORTS.

Grindstones continue to be imported into the United States, and these imports are kept up largely by the demand of the large pulp manufacturers for the Newcastle pulpstones, which are obtained from Newcastle-upon-Tyne, in England. Other imported grindstones are a coarse, hard one from Bavaria, which is used for razor grinding, and a very hard one from Edingburgh, Scotland, called the Craigleith, that is used for special purposes in the glass trade. In reporting the imports of grindstones the Bureau of Statistics of the Treasury Department limits the statements to the value, no figures relating to the quantity having been published since 1883.

The amount and value of the grindstones imported into the United States since 1868 are given below:

Grindstones imported and entered for consumption in the United States, 1868 to 1901, inclusive.

Year ending—	Finished.		Unfinished or rough.		Total value.
	Quantity.	Value.	Quantity.	Value.	
June 30—	*Long tons.*		*Long tons.*		
1868		$25,640		$35,215	$60,855
1869		15,878		99,715	115,593
1870		29,161		96,444	125,605
1871	385	43,781	3,957.15	60,935	104,716
1872	1,202	13,453	10,774.80	100,494	113,947
1873	1,437	17,033	8,376.84	94,900	111,933
1874	1,443	18,485	7,721.44	87,525	106,010
1875	1,373	17,642	7,656.17	90,172	107,814
1876	1,681	20,262	6,079.34	69,927	90,189
1877	1,245	18,546	4,979.75	58,575	77,121
1878	1,463	21,688	3,669.41	46,441	68,129
1879	1,603	24,904	4,584.16	52,343	77,247
1880	1,573	24,375	4,578.59	51,899	76,274
1881	2,064	30,288	5,044.71	56,840	87,128
1882	1,705	30,286	5,945.61	66,939	97,225
1883	1,755	28,055	6,945.63	77,797	105,852
1884					[a] 86,286
1885					50,579
December 31—					
1886					39,149
1887					50,312
1888					51,755
1889					57,720
1890					45,115
1891					21,028
1892					61,052
1893					59,569
1894					52,688
1895					54,276
1896					66,195
1897					49,496
1898					62,973
1899					63,852
1900					92,581
1901					88,871

[a] Since 1884 not separately classified.

Grindstones have begun to be exported in considerable numbers, so that now the total of the exports is greater than that of the imports, which are for the most part pulpstones. The use of the American pulpstone is gradually increasing, and will in the end cause the importation of these stones to decrease.

BUHRSTONES AND MILLSTONES.

KINDS AND SOURCES.

There are many varieties of stone that are used in the manufacture of buhrstones or millstones, and these names are retained on account of the stones formerly being used for the same purposes as the regular buhr. The American millstone varies from a sandstone to a quartz conglomerate, which occurs along the eastern slopes of the Appalachian Mountains from New York to North Carolina, and is known by different names, according to the locality from which it is obtained. The New York millstone quarries are located in a belt of sandstone and conglomerate on the Shawangunk Mountains, extending across the towns of Rochester, Marbletown, Wawarsing, Gardener, and New Paltz, in Ulster County. The stones vary greatly, some being very fine grained, while others are coarse, according to the portion of the rock from which they are manufactured. They are all, however, known as "Esopus stone." The largest stone made is 6 feet in diameter, and the smallest is 18 inches. The face of these stones varies from 1 to 2 feet. In Pennsylvania the quarries are located in Lancaster County, and the millstones are known as "Turkey Hill" and "Cocalico," the former being found on Turkey Hill, near Bowmansville, and the latter near Durlach and Lincoln. In the vicinity of Prices Fork, Montgomery County, Va., a sandstone conglomerate occurs on Brush Mountain. Quarries have been opened in it for a distance of 3 miles. The stone occurs in various colors from white and gray to bluish, and is also of different grades of grit. These stones are known on the market as "Brush Mountain" stone. There is practically the same variation in the sizes of the stone manufactured at all these different quarries. At Faith, Rowan County, N. C., in the Dunn Mountain granite belt, a stone is being quarried and manufactured into millstones. The demand for this stone is increasing, and it is expected that the production in 1902 will be from two to three times that of 1901. The stones are used mostly for grinding corn, oats, etc., and are sold in North Carolina, Georgia, and other Southern States. The four localities just mentioned were the only ones at which millstones were quarried during 1901, and there was an increase of production from each of them. In Moore County, N. C., millstones were formerly obtained and were known by the name of "North Carolina grit." A buhrstone or millstone was also formerly obtained from the Berea grit (sandstone) at Peninsula, Ohio, the grit being similar to that which is now used in the manufacture of the Peninsula pulpstone. In many of the isolated mountain districts, especially of the Southern States, there is a great variety of stones that are being used for buhrstones. The owners of many of the small mills of these mountain districts, who grind wheat and corn, often quarry in their vicinity the stone they use and work it up themselves. At a number of places in North Carolina where scrap mica is ground buhrstones are used, some of which are quarried locally.

There are still a good many buhrstones imported from France, Belgium, and Germany, and these are of a decidedly different character and are considered to give better satisfaction than the American stone. This may have been true when the buhrstones were used principally for making wheat flour, but there is no reason why the American stone should not give just as good satisfaction for the purposes for which they are now used. The French buhr is considered the best, and both it and the Belgian are hard and porous rocks, consisting of small particles of quartz mixed with calcareous material. The German buhr is said to be a basaltic lava. These various stones are usually brought into this country in pieces and then made up into the buhrstone, thus escaping the higher duty of a finished product.

Whereas formerly there were a large number of buhrstones used in the United States, principally in grinding wheat, there are now but very few used for that purpose on account of the introduction of the roller-mill process. It is only in certain mountain districts where railroad facilities are wanting that buhrstones are still used for this purpose. They are now used quite extensively for grinding the coarser cereals, mineral paint ores, fertilizers, cement rock, barytes, and other minerals, and such use is increasing each year. For such grinding American stones seem to be and should be as satisfactory as the foreign.

PRODUCTION.

There has been a continual increase in the production of buhrstones since 1894, when it had dropped down to its lowest point, the value of the production being only $13,887. In 1901 the value of the buhrstones produced was $57,197, as compared with a value of $32,858 in 1900, and of $28,115 in 1899. Although there is but little chance of the production of buhrstones equaling the value of the production of the early eighties, which was from $150,000 to $200,000 per year, yet there will probably be a continued increase for a number of years to come. The importation of buhrstones began to decline sharply in 1883, and there has been a gradual falling off since then.

The value of the production of buhrstones in the United States since 1880 is given in the following table:

Value of buhrstones produced in the United States from 1880 to 1901.

Year.	Value.	Year.	Value.
1880	$200,000	1891	$16,587
1881	150,000	1892	23,417
1882	200,000	1893	16,639
1883	150,000	1894	13,887
1884	150,000	1895	22,542
1885	100,000	1896	22,567
1886	140,000	1897	25,932
1887	100,000	1898	25,934
1888	81,000	1899	28,115
1889	35,155	1900	32,858
1890	23,720	1901	57,179

IMPORTS.

Although there was a considerable increase in the importation of buhrstones and millstones in 1900, and again in 1901, over that of any year since 1894, yet the general tendency has been for the imports to grow less, not only on account of the introduction of the roller process for making wheat flour, but because the buhrstones produced in this country are as satisfactory as the foreign ones for the purposes for which the stones are now used.

The value of buhrstones and millstones imported into the United States since 1868 is given in the following table:

Value of buhrstones and millstones imported into the United States from 1868 to 1901, inclusive.

Year ending—	Rough.	Made into millstones.	Total.	Year ending—	Rough.	Made into millstones.	Total.
June 30—				December 31—			
1868	$74,224	....	$74,224	1886	$29,273	$662	$29,935
1869	57,942	$2,419	60,361	1887	23,816	191	24,007
1870	58,601	2,297	60,898	1888	36,523	705	37,228
1871	35,406	3,698	39,104	1889	40,432	452	40,884
1872	69,062	5,967	75,029	1890	32,892	1,103	33,995
1873	60,463	8,115	68,578	1891	23,997	42	24,039
1874	36,540	43,170	79,710	1892	33,657	529	34,186
1875	48,068	66,991	115,059	1893	29,532	729	30,261
1876	37,759	46,328	84,087	1894	....	....	[a] 18,087
1877	60,857	23,068	83,925	1895	....	....	[a] 20,316
1878	87,679	1,928	89,607	1896	....	....	[a] 26,965
1879	101,484	5,088	106,572	1897	....	....	[a] 22,956
1880	120,441	4,631	125,072	1898	22,974	1,025	23,999
1881	100,417	3,495	103,912	1899	18,368	513	18,881
1882	103,287	747	104,034	1900	27,960	944	28,904
1883	73,413	272	73,685	1901	40,885	1,302	42,187
1884	45,837	263	46,100				
1885	35,022	455	35,477				

[a] Not separately classified.

PUMICE.

Pumice is a general name given to the loose, spongy, cellular, or frothlike parts of lava. This peculiar structure is undoubtedly due to the escape of steam or gas through its mass while in a state of fusion. It is among the acid lavas that the most perfect forms of pumice are found, although some of the basic kinds sometimes assume a similar structure. Pumice is buoyant and floats readily on water, owing to its extremely porous nature. When examined under the microscope, an acid pumice stone is observed to be made up of a groundmass of glass, crowded with an extremely large number of minute cavities that are elongated in the direction of the flow of the lava, and with abundant crystallites. The solid pumice stone that is found comes under this head.

Pumice, as it is known commercially, is also made from another volcanic product called volcanic ash. This includes the finer detritus that is ejected in many eruptions and is often deposited at considerable distances. It is an exceedingly fine, light-gray powder, resembling an ash, but when examined under the microscope it is seen to consist partly of minute rough, rounded, angular, or flaky grains of a glassy nature, and partly of minute crystallites, and it is in reality merely a lava in extremely fine subdivision. When these components have had an opportunity to accumulate, they have sometimes become consolidated into rock formations. Where they have been deposited in the sea or lakes they are liable to have their outer margin pass insensibly into ordinary sediments.

The following analyses will give an idea of the chemical composition of pumice:

Analyses of pumice from Utah and Nebraska.[a]

Constituent.	1. Millard County, Utah.	2. Nebraska.
	Per ct.	*Per ct.*
Silica (SiO_2)	72.58	71.97
Alumina (Al_2O_3)	15.66	14.86
Ferric oxide (Fe_2O_3)	.96	.88
Lime (CaO)	.73	.77
Soda and potash (Na_2O and K_2O)	8.28	8.28
Loss on ignition	3.64	3.64

Both the solid pumice stone and the volcanic ash are mined as a source of commercial pumice. Where necessary, it is crushed and bolted and is used in the manufacture of various polishing powders and scouring stones.

During the summer of 1897 several extensive deposits of pumice were discovered in Nebraska, in the Tertiary deposits, the most extensive exposure being in Sioux, Dawes, Scotts Bluff, Banner, and Cheyenne counties. Another deposit was discovered in South Dakota about 3 miles east of Pine Ridge Agency. The volcanic ash of which these deposits are composed was probably brought by the winds from volcanoes in Colorado and New Mexico, and deposited in the lakes and other water courses which at that time covered this region. A deposit of lump pumice stone was found in Millard County, Utah, and is the only known deposit of lump pumice stone in the United States. These deposits were described in detail in the Nineteenth Annual Report of the Geological Survey, Part VI, page 529. A large deposit of pumice is reported as occurring in Sonoma County, Cal.

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[a] By W. H. Andrews, Nineteenth Ann. Rept. U. S. Geol. Survey, Part VI.

On account of the distance of these deposits from the railroad and from the large markets, they have not been able to compete with the pumice imported from Lipari, which is shipped largely as ballast and which sells in New York, after being ground and bolted, at from 2 to 2½ cents per pound. For this reason the production of pumice in the United States, which was begun in 1897 by the shipment of 158 tons, and of over 600 tons in 1898, has ceased.

Pumice has been found in Hawaii in sufficient quantity to more than furnish the demand of this country if it can compete with that from Lipari.

Almost the entire demand for pumice has been supplied from a deposit in the northwestern part of the island of Lipari, which is just north of the island of Sicily in the Tyrrhenian Sea, about 80 per cent of that used in the United States being shipped directly here from that island. The deposit covers about 3,706 acres and varies in depth from 3 to 13 feet, consisting of an irregular mixture of pumice stone and volcanic ash. There are from 200 to 220 small quarries located on the deposit, but the majority of them are worked only from May to October. As the pumice stone is quarried, it is sold to merchants, who sort it according to color, weight, and size, and then send it to Lipari, where it is cleaned and prepared for market, the refuse stone and small pieces being ground to powder in handmills.

The amount of pumice imported into the United States can not be even approximately given, as no record of it is kept by the Bureau of Statistics of the Treasury Department, only the value of the pumice imported being recorded. Since 1893, with the exception of 1896, the value of the imports has varied between $43,788 and $65,930. In 1896 no imports at all were reported.

INFUSORIAL EARTH AND TRIPOLI.

Under this head are included all porous, siliceous earths of organic origin, such as infusorial earths, diatomaceous earth, and tripoli. These are formed from the siliceous shells of diatoms and other microscopic species, and occur in deposits that are often many miles in area. Deposits of these earths occur in many of the States on the eastern slopes of the Appalachian Mountains and in two of the Western States, Nevada and California. Besides these two States, large deposits of infusorial earth or tripoli have been found in Maine, New Hampshire, Massachusetts, Connecticut, New Jersey, Maryland, Virginia, Georgia, Alabama, and Arkansas. A porous siliceous rock which occurs near Carthage, Newton County, Mo., is included here, as it is used for the same purposes, although it is not of the same origin as the infusorial earths. The infusorial-earth deposits of Maine occur near Blue Hill, Hancock County, and were operated during 1901. The only deposit that is being worked in New Hampshire is the one on Troy Mountain, Troy, Cheshire County. The material, after being mined, is calcined, bolted, and manufactured at Keene into cleaning powders and polishers by the producers of the raw material. A deposit of tripoli was worked during 1901 at Framingham, Middlesex County, Mass., the material being crushed, burned, and washed before being placed on the market. Mining is carried on quite extensively at the infusorial-earth deposit in Calvert County, Md. In King George County, Va., near Wilmot, on the Potomac River, a deposit of infusorial earth is being opened up which is reported to be a horizontal bed 16 to 30 feet thick and exposed for 1,000 feet along the river. The material is very smooth and uniform throughout the deposit, and is free from gravel, dirt, etc. A considerable part of the material mined is to be used in the manufacture of hollow, furnace, and building brick and an infusorial-earth plastic asbestos cement. Another deposit in Virginia that has been worked quite extensively is near Richmond, in Henrico County. In Murray County, Ga., a tripoli deposit, located about 10 miles east of Dalton, has been worked to some extent. The material, before shipping, is finely ground. The siliceous material that is found near Carthage, Newton County, Mo., is evidently residual silica left from an impure siliceous limestone by the leaching out of the calcium carbonate. Its character is such that it answers all the purposes of an infusorial earth or tripoli so far as polishing qualities are concerned, and on account of its exceeding porosity and yet compact nature it makes an excellent material for water filters, and it can be readily cut into any desirable shape. On account of this material being used for water filters its production is larger than that of any other deposit of this character. In Esmeralda County, Nev., a limited amount of infusorial earth is mined each year, the product being sacked for shipment just as it is quarried. There was no production of infusorial earth or tripoli in Connecticut, New Jersey, Alabama, Arkansas, or California during 1901, but in Connecticut there was some quartz mined and ground and sold under the name of tripoli.

Perhaps the largest and most noted of infusorial-earth deposits[a] are those at Niederohe and Oberohe, in the Lueneburg Heath, North Germany, a few miles from Unterleuss, the nearest railroad station. This material is sometimes found 5 to 6 meters below the surface; the stripping of this covering is usually done in spring and fall, and during the summer the infusorial earth is quarried, dried, and prepared for market. These deposits vary from 6 to 15 meters in thickness. A large amount of this material is exported to all parts of the world.

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[a] Oil, Paint, and Drug Reporter, June 3, 1901.

USES.

Infusorial earth, tripoli, etc., are included with the abrasives because they are used to a certain extent in the manufacture of polishing powders and scouring soaps, although this is not their only use. Owing to its porous nature infusorial earth has been found to make an excellent absorbent for the manufacture of dynamite from nitroglycerin, and its nonconductivity of heat gives it value for packing for boilers, steam pipes, and safes, and as a base for fire- and heat-retarding cements. It is also being used to a considerable extent for the manufacture of fireproof building materials, such as solid brick, hollow brick for partition walls, floors, etc.

PRODUCTION.

There is considerable variation in the quantity and value of infusorial earth produced in the United States from year to year, and this is due partly to the varying demand for the material as other minerals are substituted for it in some of its uses, and partly to a production of the raw product in one year sufficient to last the manufacturers a year or more. The variation given in the values of the production is chiefly due to the different conditions of the material as it is marketed, some being sold just as it is mined, although most of it is subjected to treatment. The production of 1901 amounted to 4,020 tons, valued at $52,950, as compared with 3,615 tons, valued at $24,207, in 1900. This increase in value is partly due to the large production of the American Tripoli Company, of Seneca, Mo.

The quantity and value of infusorial earth obtained in the United States since 1880 are given in the following table:

Production of infusorial earth from 1880 to 1901.

Year.	Quantity.	Value.	Year.	Quantity.	Value.
	Short tons.			*Short tons.*	
1880	1,833	$45,660	1891		$21,988
1881	1,000	10,000	1892		43,655
1882	1,000	8,000	1893		22,582
1883	1,000	5,000	1894	2,584	11,718
1884	1,000	5,000	1895	4,951	20,514
1885	1,000	5,000	1896	3,846	26,792
1886	1,200	6,000	1897	3,833	22,385
1887	3,000	15,000	1898	2,733	16,691
1888	1,500	7,500	1899	3,302	25,302
1889	3,466	23,372	1900	3,615	24,207
1890	2,532	50,240	1901	4,020	52,950

CRYSTALLINE QUARTZ.

Under this head is included the crystalline quartz which is used principally as a wood finisher, and the entire production of this mineral for this purpose is credited to Connecticut. Some quartz is pulverized and sold under the name of tripoli. The quartz rock which is used for wood finishing must be very pure and white and is crushed and ground to an impalpable powder. It is then floated, precipitated, dried, and bolted. Considerable of the quartz is ground by the dry process, but it does not make as good a product for this purpose as that made by the wet process, nor does it bring as high a price. This flour quartz is combined with a proper portion of japans, oils, etc., to make a paste. When used, the paste is reduced with turpentine or benzine, so that it will flow freely under the brush, and it is then painted on the smooth, fresh surface of the wood. After being left until it becomes "set up," which takes from a few minutes to half an hour, it is wiped off the surface, leaving the pores of the wood filled with minute particles of quartz which have been carried into them by the oil. Wood that has been treated in this way will take a high polish.

There is considerable quartz sand used in the stonecutting trade, especially by the marble men, as an abrasive. A limited amount of quartz is crushed and sized and used in the manufacture of sandpaper.

PRODUCTION.

There were 14,050 tons of crystalline quartz, valued at $41,500, produced in 1901, as compared with 14,461 tons, valued at $40,705, in 1900. These values are for the crude quartz and not after it has been prepared for market, when its value is from three to four times as much. The quantity and value of crystalline quartz produced in the United States since 1894, the first year it was obtained, are given in the following table:

Production of quartz crystal since 1894.

Year.	Quantity.	Value.	Year.	Quantity.	Value.
	Short tons.			*Short tons.*	
1894	6,024	$18,054	1898	8,312	$23,990
1895	9,000	27,000	1899	13,600	39,000
1896	6,000	18,000	1900	14,461	40,705
1897	7,500	22,500	1901	14,050	41,500

GARNET.

OCCURRENCE.

Garnet is one of the commoner minerals, is found in many of the crystalline rocks, and is often a product of contact metamorphism. It is usually associated with mica (muscovite) in pegmatitic dikes, although sometimes occurring but sparingly.

PRODUCTION.

The statistics of the production of garnet in the United States have only been taken since 1894, and there has been considerable variation in both the production and the value. On account of the variation of quality of the garnet from the different localities, the price varies from $20 to $60 per ton when cleaned and prepared for market. The higher price has been obtained for the North Carolina garnet. Until 1900 the North Carolina garnet was not included in these statistics, and this is one reason for the increase in production and value of garnet during 1900 and 1901. The production for 1901, as reported to the Survey, is 4,444 tons, valued at $158,100, as compared with 3,185 tons, valued at $123,475, in 1900, which is an increase of 1,259 tons and of $34,625 in value. The average value per ton of the garnet produced in 1901 was $35.57, as compared with an average value of $38.76 per ton in 1900. The production of each year since 1894 is given in the following table:

Production of abrasive garnet since 1894.

Year.	Quantity.	Value.
	Short tons.	
1894	2,401	$90,660
1895	3,325	95,050
1896	2,686	68,877
1897	2,554	80,853
1898	2,967	$86,850
1899	2,765	98,325
1900	3,185	123,475
1901	4,444	158,100

CORUNDUM AND EMERY.

A distinction is often made between corundum and emery, many not recognizing emery as a variety of corundum. There are three names in constant use to designate the varieties of corundum:

(1) Sapphire, which includes all corundums of whatever color that are transparent to semitransparent;

(2) Corundum, including the translucent to opaque varieties of all colors;

(3) Emery, which is a mechanical admixture of corundum and magnetite or hematite.

It is these last two varieties that are used in the arts for abrasive purposes, emery being used in very much larger quantities than corundum. It is, of course, the presence of corundum in the emery that gives to it its abrasive value; and the abrasive efficiency of the emeries will vary according to the percentage of corundum that they contain.

Next to the diamond, corundum is the hardest mineral known, having a hardness of 9, while the diamond is 10, and it is this hardness that makes the corundum of so great value as an abrasive. Corundums vary slightly in hardness, the sapphire varieties generally being considered the hardest, and of these the blue sapphire stands at the head, All corundums do not behave alike when heated to the high temperature necessary for the manufacture of the vitrified wheels, and although most corundums can, if properly cleaned, be used in the manufacture of these wheels, some will, when heated, crumble to a powder. It is, therefore, very essential before beginning to operate a corundum deposit to test the ore thoroughly as to whether it can be commercially cleaned, and to ascertain the adaptability of this cleaned product to the manufacture of vitrified and other wheels.

There are noticeable changes in the condition of the corundum and emery industry at the close of 1901 from its condition at the close of 1900. Of these changes the more prominent are the production of artificial corundum, the exploitation and development of the recently discovered corundum deposits in Montana, the production of the corundum occurring in quartz-schist in Clay County, N. C.; the production of corundum at the mines in Ontario, Canada, and its importation into the United States; the transfer of the Chester emery mines to the Ashland Emery and Corundum Company, and the entrance of the Hampden Emery Wheel Company as producers in the Peekskill emery field.

There is a constant increase in the demand for such abrasives as corundum and emery, which is due to the large increase in manufacturing, especially of agricultural machines, and also to the improved methods that have been devised for manufacturing emery and corundum stones and wheels of all shapes and sizes. That the supply could readily exceed the demand is very evident when it is considered that there are only about 16,000 tons of corundum and emery used in the United States. Of this amount, however, there are 11,723 tons imported, so there is room for a large increase in the production of these abrasives in the United States. At the present time there are only about 500 tons of corundum being used, this being due not to the small demand for it, but to the lack of this material on the market. If the price is maintained at 8 to 10 cents per pound, there will be but a relatively small amount of corundum used, but with a slight decrease in price there will be a great increase in the use of corundum, which will be at the expense of the emery. At the same time, with a decrease in price the more favorable must be the location of the deposits for mining and for railroad facilities in order to bear this competition with the emery. With the known occurrences of corundum in the United States there should be no drawback to such production of it as fully to satisfy the market's demand.

PRODUCTION.

The production of corundum during 1901 was confined entirely to North Carolina, there being three mines that aided in this production—the Corundum Hill at Cullasagee, Macon County; the Sealy Mountain, Clay County; and the Caney Creek, Jackson County. The output was small as compared with the possibilities and extent of the corundum deposits that are known in North Carolina. With the development of the deposits of Montana, the production for 1902 should be much greater than that of 1901, which was somewhat larger than that of 1900. The emery production has been confined to the same localities as last year, the mines at Chester, Mass., and those in the vicinity of Peekskill, N. Y. The amount of emery produced was a little less than the year before. The total amount of emery and corundum produced in the United States during 1901 was 4,305 tons, valued at $146,040, as compared with 4,305 tons, valued at $102,715, in 1900. If this production is compared with the amount of emery imported, it will be found that it is less than one-half the latter in amount and also less than one-half in value.

The amount and value of the production of emery and corundum in the United States since 1881 are given in the table below, but in each case it is the total amount of the two that is given:

Annual production of corundum and emery since 1881.

Year.	Quantity.	Value.	Year.	Quantity.	Value.
	Short tons.			*Short tons.*	
1881	500	$80,000	1892	1,771	$181,300
1882	500	80,000	1893	1,713	142,325
1883	550	100,000	1894	1,495	95,936
1884	600	108,000	1895	2,102	106,256
1885	600	108,000	1896	2,120	113,246
1886	645	116,190	1897	2,165	106,574
1887	600	108,000	1898	4,064	275,064
1888	589	91,620	1899	4,900	150,600
1889	2,245	105,567	1900	4,305	102,715
1890	1,970	89,395	1901	4,305	146,040
1891	2,247	90,230			

IMPORTS.

With the development of the Canadian corundum deposits there has been a considerable amount of corundum imported into the United States from this source, and in 1901 it amounted to over 200 tons. There has also been a small amount of corundum imported from India. Of emery, however, there is over twice as much imported as is produced in the United States, and it is obtained from Turkey and the island of Naxos, one of the Cyclades group in the Grecian Archipelago. This large importation is not due to the scarcity of emery in this country, but to the low price at which the Turkish and Grecian ores can be placed on the docks at Boston, New York, or Philadelphia, having been brought over as ballast.

There are now being imported into the United States nearly 12,000 tons of emery per year, and the total consumption is only a little over 16,000 tons. Thus the imports are nearly three times the home production. There is plenty of opportunity for a decided increase in the production of emery in this country to replace a part, at least, of that imported. This may also be said of corundum; for if a good clean product were placed on the market, it would be used to the extent of

1,000 or 1,500 tons, to the exclusion of the same amount of emery; and with an even slight decrease in price of the corundum, it would be used in much larger quantity. In the following table are given the amount and value of emery imported from 1867 to 1901:

Emery imported into the United States from 1867 to 1901, inclusive.

Year ending—	Grains.		Ore or rock.		Pulverized or ground.		Other manufactures.	Total value.
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Value.	
June 30—	*Pounds.*		*Long tons.*		*Pounds.*			
1867	....	....	428	$14,373	924,431	$38,131	....	$52,504
1868	....	....	85	4,531	834,286	33,549	....	38,080
1869	....	....	964	35,205	924,161	42,711	....	77,916
1870	....	....	742	25,335	644,080	29,531	....	54,866
1871	....	....	615	15,870	613,624	28,941	....	41,811
1872	....	....	1,641	41,321	804,977	36,103	....	77,424
1873	610,117	$29,706	755	26,065	343,828	15,041	$107	70,919
1874	331,580	16,216	1,281	43,886	69,890	2,167	97	62,366
1875	487,725	23,345	961	31,972	85,853	2,990	20	58,327
1876	385,246	18,999	1,395	40,027	77,382	2,533	94	61,653
1877	343,697	16,615	852	21,964	96,351	3,603	....	42,182
1878	334,291	16,359	1,475	38,454	65,068	1,754	34	56,601
1879	196,633	24,456	2,478	58,065	133,556	4,985	....	87,506
1880	411,340	20,066	3,400	76,481	223,855	9,202	145	105,894
1881	454,790	22,101	2,884	67,781	177,174	7,497	53	97,432
1882	520,214	25,314	2,765	69,432	117,008	3,708	241	98,695
1883	474,105	22,767	2,417	59,282	93,010	3,172	269	85,490
1884	143,267	5,802	4,145	121,719	513,161	21,181	188	148,890
1885	228,329	9,886	2,445	55,368	194,314	8,789	757	74,800
December 31—								
1886	161,297	6,910	3,782	88,925	365,947	24,952	851	121,638
1887	367,239	14,290	2,078	45,033	[a] 144,380	6,796	2,090	68,209
1888	430,397	16,216	5,175	93,287	....	....	8,743	118,246
1889	503,347	18,937	5,234	88,727	....	....	111,302	218,966
1890	534,968	20,382	3,867	97,939	....	....	5,046	123,367
1891	90,658	3,729	2,530	67,573	....	....	....	71,302
1892	566,448	22,586	5,280	95,625	....	....	2,412	120,623
1893	516,953	20,073	5,066	103,875	....	....	3,819	127,767
1894	597,713	18,645	2,804	51,487	....	....	1,841	71,973
1895	678,761	25,066	6,803	80,386	....	....	27,586	133,038
1896	755,693	28,493	6,389	119,738	....	....	....	148,231
1897	539,176	20,865	5,213	107,655	....	....	2,211	130,531
1898	577,655	23,320	5,547	106,269	....	....	3,810	133,399
1899	728,299	29,124	7,435	116,493	....	....	11,514	157,131
1900	661,482	26,520	11,392	202,980	....	....	10,006	239,506
1901	1,086,729	43,217	12,441	240,856	....	....	10,926	294,999

[a] To June 30 only; since classed with grains.

It may be of interest to give here the output of the Canadian corundum mines, whose commercial product was placed on the market in 1901 for the first time. The total amount of corundum ore mined in 1901 was 4,133 tons, from which there were produced 868,590 pounds of commercial corundum, showing the ore to be carrying a little over 10 per cent of corundum. Of this amount, 171,537 pounds were sold in Canada, 20,331 pounds in England, 5,320 pounds in other parts of Europe, and 576,402 pounds in the United States, the latter country taking over one-half of the entire production.

With corundum there should be a good opportunity for building up an export trade from the United States and Canada; for as far as can be learned no corundum is produced elsewhere, except a very small amount in India. There is a large and growing demand for corundum in Great Britain, Germany, France, and Sweden; and there will be a small demand for it from South American countries and from Australia. The large deposits of the mineral that are known to exist in the United States and Canada should be able to supply the world's demand for this abrasive.

ARTIFICIAL ABRASIVES.

During the last fifteen years many experiments and investigations have been made with the view of producing an artificial abrasive that would be equal or superior to the natural products. These experiments have met with success, and there are now three artificial abrasives on the market; and for two of these there is already a considerable demand. These are carborundum, crushed steel, and artificial corundum. The production of the first has increased at a phenomenal rate since its introduction in 1893; and though the production of crushed steel increased rapidly when it was first used, for the last few years there has been but little change in production. Artificial corundum is the latest of the artificial abrasives, and made its first appearance in the latter part of 1901. The effect that these artificial abrasives will have on the production of the natural products can not yet be definitely determined. It will be felt principally among those abrasives that are included under the second group, which have to be mechanically separated from the associated gangue minerals. Crushed steel has a field that is practically not entered by the other abrasives, as the greater portion of that manufactured is used in the stone-cutting trade, particularly by the marble and granite cutters. Carborundum and artificial corundum will be strong competitors of corundum and emery, and perhaps of some garnet, but not of the other abrasives, as they are sold at too low a price. With emery selling at its present price, carborundum and artificial corundum will not have any special competition, as they will be manufactured into a higher grade of abrasive. They will, however, be strong competitors of corundum, which is the best of the natural products. At the present time there is so small an amount of corundum produced that there is really no competition between it and the carborundum. If, however, the corundum should be mined and placed on the market in much larger quantities the carborundum would be at once one of its strongest competitors. With the emery the carborundum has been already a competitor to some extent, but on account of the greater cost of the carborundum it has not thus far made much inroad on the emery market. These artificial abrasives hold a strong place in the abrasive industry, and their production is constantly increasing. This will continue to be the case, at least with such abrasives as carborundum and artificial corundum, which are in the same scale with the best natural products.

CARBORUNDUM.

Carborundum is composed of carbon and silicon, containing 32 per cent of the former and 68 per cent of the latter. As it comes from the furnace it is in the shape of black crystals of great brilliancy and hardness. These are crushed under rolls into grains of various sizes, which are washed in a solution of acid and water to remove soluble material, and then dried and sifted to uniform sizes.

The manufacture of carborundum, which was started in 1893, has had a remarkable growth since that time, and its production has increased from a few hundred pounds to nearly 4,000,000 pounds per year. This material was discovered by Mr. E. G. Achison, formerly of Monongahela, Pa., who was conducting a series of experiments in the hope of securing a substitute for the diamond as an abrasive. When first manufactured considerable difficulty was experienced in obtaining a uniform product, and a great deal of complaint was made of the material put on the market, for some lots would have excellent abrasive qualities, while others would be of but little value for abrasive purposes. One of the principal objections to the carborundum was its brittleness and the ease with which it was converted into a powder; and thus while it would cut very readily when first used, it would very soon crush to a fine powder when used in the form of grains, or the grains would break off when used in the form of a wheel. Experiments were constantly made to remedy this defect, with the result that now a nearly uniform product is being turned out by the Carborundum Company, and is giving good satisfaction as an abrasive, although the crystals are still brittle. The first use that was made of carborundum was by the lapidaries in the place of diamond powder; but now it is being used to a certain extent as a general abrasive material, and is made into hones, wheels, and other forms. The price has been reduced from $15 per pound until it can now be bought for from $160 to $200 per ton. When first made the production would not average much over one-quarter of a pound per day; but in 1893 it had increased to 15,200 pounds, and by the end of 1894 the company had developed its plant and method of manufacture so that the production reached 100,000 pounds of carborundum per year. In 1895 the company's factory at Niagara Falls was built, and in 1896 it commenced to use 1,000 electrical horsepower, which was increased to 3,000 horsepower in 1898. Besides the plant for the production of the carborundum, the company also has an extensive and complete plant for the manufacture of all kinds of carborundum wheels and stones, and of carborundum paper and cloth. It now has four 16-foot kilns for vitrifying wheels.

Production.—The growth of the carborundum industry has been remarkable. During 1901 the total production of carborundum was 3,838,175 pounds, valued at from 8 to 10 cents per pound. Much of the carborundum manufactured is now exported. It is interesting in noting the growth of this industry to compare the statistics showing the production of carborundum for each year, and in the following table the production of this abrasive is given for the years 1892 to 1901, inclusive.

Production of carborundum from 1892 to 1901, inclusive

Year.	Amount.	Year.	Amount.
	Pounds.		*Pounds.*
1892	1,000	1897	1,256,400
1893	15,200	1898	1,447,200
1894	52,200	1899	1,741,245
1895	226,000	1900	2,634,900
1896	1,207,800	1901	3,838,175

CRUSHED STEEL.

The greater part of the crushed steel that is manufactured is used in the stone-cutting trade, particularly by the marble and granite cutters; and it has a field that is not entered by corundum, and to but a limited extent by emery. The crushed steel is used in sawing, grinding, rubbing, and polishing stone of every kind. It is also used to some extent by brick manufacturers for grinding the finer qualities of brick that are used for arch purposes. Thus, the production of crushed steel is apt to fluctuate with the condition of the building trades. The fine grades of crushed steel, known as steel emery and rouge, are used in considerable quantities by lens workers, glass bevelers, and other glass grinders. The Crushed Steel Company is manufacturing another product, known as "steelite," which is meeting with some success in railroad and other machine shops for use in throttle and other valve grinding.

Production.—The production of crushed steel by the Pittsburg Crushed Steel Company in 1901 amounted to 690,000 pounds, being 10,000 less than the production of 1900. Crushed steel is now being quoted on the market at 5½ cents per pound f. o. b. Pittsburg. In the following table is given the production of crushed steel for the last four years:

Production of crushed steel in the United States from 1898 to 1901, inclusive.

Year.	Amount.	Year.	Amount.
	Pounds.		*Pounds.*
1898	660,000	1900	700,000
1899	675,000	1901	690,000

ARTIFICIAL CORUNDUM.

A new industry that has recently been started is the manufacture of artificial corundum. The method of manufacture of this product is a secret process, but it can be stated in general as consisting in the conversion of the mineral bauxite (a hydrous aluminum oxide) into corundum by means of very great heat and pressure in an electrical furnace. Experiments have been conducted for some time along this line, but it was only within the last two years that these experiments reached such a point that they could be considered as favorable commercially.

The idea that bauxite is changed into corundum by heat and pressure is not new, for in 1861 Prof. T. Sterry Hunt, of the geological survey of Canada, in an article on "The origin of some magnesian and aluminous rocks," described the occurrence of bauxite at Baux, in the south of France, and stated that "by an intense heat this substance is converted into crystalline corundum resembling emery in its physical character." In a recent article on the "Occurrence of corundum in quartz-schist in North Carolina,"[a] the schists are considered the result of metamorphism of sandstones and shales formed from alluvial deposits many thousand feet in thickness; and these shales, which were rich in alumina, probably in the form of bauxite, had their excess of alumina crystallized out as corundum during their metamorphism. This view is strengthened by the artificial production of corundum from bauxite by means of high heat and pressure.

The Norton Emery Wheel Company has erected a plant at Niagara Falls for the manufacture of artificial corundum, and already two or three carloads of the material have been manufactured and shipped to the company's factory, where it has been made into wheels, etc. It is reported that they give very good satisfaction. Although all of the experiments made with artificial corundum have not been satisfactory, this has been true of all artificial products in the first stages of their manufacture; and the results obtained from carload lots of material that were sent to the factory would seem to indicate that the manufacture of a uniform product of this material is assured. The manufacture of artificial corundum is primarily for the use of the Norton Emery Wheel Company; but it will also very probably be manufactured for the general corundum market. The crude material, as it comes from the furnace, is often in rather large masses, which are shipped to Worcester, where it is crushed into grains and graded.

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[a] Am. Jour. Sci., Vol. X, 1900 p. 297.

What effect the manufacture of this artificial corundum will have on the production of corundum, and also on the manufacture of carborundum, can not yet be told; but if it proves equal to them in abrasive efficiency it will be a competitor of both, provided its cost of production be sufficiently low for it to be sold at a price corresponding to that of the others.

PHOSPHATE ROCK.

By Joseph Struthers.

PRODUCTION.

Progress in the development of the phosphate-rock industry in the United States, which received a setback in Florida and South Carolina during 1900, due to the scarcity of transportation facilities, combined with high ocean freights and low prices, showed considerable improvement during 1901, which promises to become more marked for the year 1902. The total production and value of phosphate rock for the year, based on the marketed product, was but little less than for 1900. In reporting the production of phosphate rock in the United States it has been deemed more desirable to consider the quantities sold during the year as equivalent to the production rather than the phosphate actually mined, an arrangement which shows more clearly the relation between the consumption and the supply.

The application of modern business methods has opened a new era in the development of the phosphate-rock industry. The larger mining companies have purchased additional properties, and the effort is being made through a combination of interests to establish a uniform price by eliminating competition. In addition, the large fertilizing companies now control a sufficient number of phosphate-rock mines to supply the raw material needed for the manufacture of fertilizers. It is worthy of note that the wildcat speculating element which predominated the field in early years has become eliminated, and the phosphate industry may now be considered as established on a conservative and substantial basis.

The description of the mining of phosphate rock in Florida, South Carolina, and Tennessee will be found in the earlier reports of this series.

The industry in Florida, which has been the chief producing State since 1894, continued to show an improvement, the total output and value for that State in 1901 being the largest yet recorded. The production of hard rock and land pebble was greater than in 1900, though the quantity of river pebble was appreciably less than the output of the previous year and but slightly greater than one-half that of 1899. The increase in the production of hard rock and land pebble, however, more than offset the large decrease in the quantity of river pebble produced, so that the total production of phosphate rock in Florida during

1901 was greater than in 1900, being 751,996 long tons, valued at $3,159,473, as compared with 706,243 long tons, valued at $2,983,312, in 1900. Soft rock has not been produced in Florida since 1897, in which year a small output of 2,300 tons was reported.

In South Carolina there was a slight decrease in the output of land rock, which was nearly offset by the increased output of river rock, the total being 8,000 long tons less than in 1900; the respective reports are 225,189 long tons of land rock in 1901, as compared with 266,168 long tons in 1900, and 95,992 long tons of river rock in 1901, as compared with 62,987 long tons in 1900.

The total output of phosphate rock in Tennessee decreased from 454,491 long tons in 1900 to 409,653 long tons in 1901, which is equivalent to nearly 10 per cent decrease.

Pennsylvania contributed 893 long tons of phosphate rock during 1901, as compared with 900 long tons in 1900.

There was no reported production from Alabama, Arkansas, or North Carolina, although in the last-named State a few thousand tons of low-grade rock were mined, which was used for macadamizing streets in Wilmington.

The total quantity of phosphate rock reported to the United States Geological Survey during 1901 amounted to 1,483,723 long tons, valued at $5,316,403, as compared with 1,491,216 long tons, valued at $5,359,248, in 1900, a decrease in tonnage of 7,493 long tons and in value of $42,845. The total quantity of phosphate rock reported as mined during the year 1901 amounted to 1,440,408 long tons, which was 43,315 long tons less than the total quantity sold.

The following table gives the production in the United States of phosphate rock classified by grades from 1892 to 1901, inclusive, based on the marketed product:

Production of phosphate rock in the United States from 1892 to 1901, inclusive, based on marketed product.

State.	1892.		1893.		1894.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Florida:	*Long tons.*		*Long tons.*		*Long tons.*	
Hard rock	[a] 155,908	$859,276	215,685	$1,117,732	326,461	$979,383
Soft rock	6,710	32,418	13,675	64,626	....	....
Land pebble	21,905	111,271	86,624	359,127	98,885	296,655
River pebble	[b] 102,820	415,453	122,820	437,571	102,307	390,775
Total	287,343	1,418,418	438,804	1,979,056	527,653	1,666,813
South Carolina:						
Land rock	243,653	1,236,447	308,435	1,408,785	307,305	1,252,768
River rock	150,575	641,262	194,129	748,229	142,803	492,808
Total	394,228	1,877,709	502,564	2,157,014	450,108	1,745,576
Tennessee	....	....	....	....	19,188	67,158
Grand total	681,571	3,296,127	941,368	4,136,070	996,949	3,479,547

[a] Includes 52,708 tons of hard rock carried over in stock from 1891.

[b] Includes 12,120 tons of river pebble carried over in stock from 1891.

Production of phosphate rock from 1892 to 1901, inclusive—Continued.

State.	1895.		1896.		1897.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Florida:	*Long tons.*		*Long tons.*		*Long tons.*	
Hard rock....	307,098	$1,302,096	296,811	$1,067,525	360,147	$1,063,713
Soft rock.....	6,916	32,000	400	2,300	2,300	4,600
Land pebble..	181,011	593,716	97,936	176,972	92,132	180,794
River pebble.	73,036	185,090	100,052	300,556	97,763	244,408
Total.......	568,061	2,112,902	495,199	1,547,353	552,342	1,493,515
South Carolina:						
Land rock....	270,560	898,787	267,072	792,457	267,380	748,050
River rock....	161,415	512,245	135,351	389,192	90,900	238,522
Total.......	431,975	1,411,032	402,423	1,181,649	358,280	986,572
Tennessee........	38,515	82,160	26,157	57,370	128,723	193,115
North Carolina...	....	....	7,000	17,000	....	....
Grand total.	1,038,551	3,606,094	930,779	2,803,372	1,039,345	2,673,202

State.	1898.		1899.		1900.		1901.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Florida:	*Long tons.*		*Long tons.*		*Long tons.*		*Long tons.*	
Hard rock....	366,810	$1,396,108	460,297	$2,119,130	424,977	$2,229,373	457,568	$2,393,080
Land pebble.	155,084	293,688	177,170	515,458	221,403	612,703	247,454	660,702
River pebble.	79,000	158,000	88,953	169,473	59,863	141,236	46,974	105,691
Total.......	600,894	1,847,796	726,420	2,804,061	706,243	2,983,312	751,996	3,159,473
South Carolina:								
Land Rock...	298,610	856,225	223,949	738,969	266,186	877,405	225,189	716,101
River Rock..	101,274	251,047	132,701	339,130	62,987	164,565	95,992	245,739
Total.......	399,884	1,107,272	356,650	1,078,099	329,173	1,041,970	321,181	961,840
Tennessee.......	308,107	498,392	430,192	1,192,916	454,491	1,328,707	409,653	1,192,090
North Carolina..	....	....	440	(*a*)	....	....	....	....
Pennsylvania....	....	....	2,000	9,000	900	4,500	893	3,000
Alabama.........	....	....	....	....	334	534	....	....
Arkansas.......	....	....	....	....	75	225	....	....
Grand total.	1,308,885	3,453,460	1,515,702	5,084,076	1,491,216	5,359,248	1,483,723	5,316,403

a Value included in South Carolina land rock.

In considering the foregoing table, as well as those relating to the domestic production which are given later in this section, it must be remembered that the marketed product is taken as a basis of production. The quantity of phosphate rock which was actually mined in Florida during 1901 was 47,984 long tons less than the quantity marketed in that year. The total quantity of hard rock mined in Florida during 1901 was 424,503 long tons, which is 33,065 long tons less than the reported marketed output. With regard to land pebble, there were 252,958 tons mined as compared with 247,454 long tons sold, which shows an increase in stock carried over from 1901 of

5,504 long tons in addition to the quantity on hand at the first of the year. The marketed product of river pebble during 1901 was 46,974 long tons, whereas the quantity mined amounted to 26,551 long tons, a decrease of 20,423 long tons to be deducted from the stock on hand at the first of the year.

In South Carolina during 1901 the quantity of land rock reported as mined was 246,713 long tons as compared with 225,189 long tons sold, which shows an increase of 21,524 long tons to be added to the stock on hand at the first of the year. With regard to river rock, the quantity mined was 86,539 long tons, and that marketed was 95,992 long tons; in this case the stock on hand at the beginning of 1901 should be decreased by 9,453 long tons to give the stock on hand at the end of the year.

The phosphate mines in Tennessee during 1901 yielded a product of 402,251 long tons, and the quantity sold was 409,653 long tons, a decrease of stock at the end of the year of 7,402 long tons.

Since 1880 the quantity and value of the phosphate rock produced in the United States have been as follows:

Production of phosphate rock in the United States from 1880 to 1901, inclusive.

Year.	Quantity.	Value.	Year.	Quantity.	Value.
	Long tons.			*Long tons.*	
1880	211,377	$1,123,823	1891	587,988	$3,651,150
1881	266,734	1,980,259	1892	681,571	3,296,227
1882	332,077	1,992,462	1893	941,368	4,136,070
1883	378,380	2,270,280	1894	996,949	3,479,547
1884	431,779	2,374,784	1895	1,038,551	3,606,094
1885	437,856	2,846,064	1896	930,779	2,803,372
1886	430,549	1,872,936	1897	1,039,345	2,673,202
1887	480,558	1,836,818	1898	1,308,885	3,453,460
1888	448,567	2,018,552	1899	1,515,702	5,084,076
1889	550,245	2,937,776	1900	1,491,216	5,359,248
1890	510,499	3,213,795	1901	1,483,723	5,316,403

PRODUCTION BY STATES.

FLORIDA.

The quantity of phosphate rock mined in Florida during 1901 was 704,012 long tons, as compared with the reported sales of 751,996 long tons. As detailed into grades the quantities mined and sold during the year were, respectively, as follows, the figures in parentheses being the quantities mined: Hard rock (424,503), 457,568 long tons; land pebble (252,958), 247,454 long tons; and river pebble (26,551), 46,974 long tons. Of the total marketed product of all grades—751,996 long tons—457,568 long tons, or 61 per cent, was hard rock; 247,454 long tons, or 33 per cent, was land pebble; and 46,974 long tons, or 6 per cent, was river pebble. There has been no reported production of soft rock since 1879, in which year 2,300 long tons were marketed.

The following table gives the quantity and value of each grade of phosphate rock produced in Florida from 1897 to 1901, inclusive, the marketed product only being considered:

Quantity and value of phosphate rock produced in Florida from 1897 to 1901, inclusive, classified by grades.

Year.	Hard rock.		Soft rock.		Land pebble.		River pebble.		Total.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Long tons.		*Long tons.*		*Long tons.*		*Long tons.*		*Long tons.*	
1897	360,147	$1,063,713	2,300	$4,600	92,132	$180,791	97,763	$244,408	552,342	$1,493,515
1898	366,810	1,396,108	....	....	155,084	293,688	79,000	158,000	600,894	1,847,796
1899	460,297	2,119,130	....	....	177,170	515,458	88,953	169,473	726,420	2,804,061
1900	424,977	2,229,373	....	....	221,403	612,703	59,863	141,236	706,243	2,983.312
1901	457,568	2,393,080	....	....	247,454	660,702	46,974	105,691	751,996	3,159,473

The review of the hard rock phosphate industry in Florida, prepared by Messrs. Auchincloss Brothers, shows that the quantity of high-grade hard rock shipped during 1901 amounted to 424,130 long tons, which is 75,574 long tons, or about 22 per cent, greater than the corresponding shipments of 348,556 long tons in 1900, although less than the quantity shipped in 1898, which was 444,675 long tons. During the year no high-grade deposits of hard rock were discovered. Small deposits under heavy overburden are occasionally found, but few are of sufficient size to warrant the erection of plants. The higher prices paid for small areas of land containing high-grade rock by miners heretofore mining on a royalty basis indicate that the limitations of the high-grade deposits are becoming more and more evident to active operators. The low ocean freight rates which ruled during the latter part of 1901 enabled the delivery of large quantities to foreign ports, so that the total shipments for 1901 were within a few thousand tons of those for 1899, which were the largest in the history of the hard-rock industry. For the same reason the c. i. f. prices for prompt delivery of high-grade rock in Europe during the latter half of 1901 have not been comparable with the corresponding f. o. b. values in the United States, which, during the year, held comparatively steady, opening in January at about $7 per long ton f. o. b. basis Fernandina, falling in midsummer, during the period of gradual depression, to as low as $6.40, and closing the year at $7.50. The market thus showed a healthier condition of the mining interests as compared to the previous depression in 1897, when f. o. b. prices at Fernandina for high-grade rock ruled for a considerable time as low as $5. During 1901 there were an average of

43 plants in operation, and 29 were closed. The sales of high-grade rock by miners for delivery during 1902 show that more than one-half of the estimated maximum production for that year has already been contracted for, and as an indication of the development of this branch of the phosphate industry on modern business principles, it may be mentioned that the greater number of these sales has been made directly to manufacturers, which leaves a comparatively small quantity for speculative resale by middlemen. The indications for the immediate future of the industry promise a healthier condition and an improvement of the market, which will doubtless be maintained by concerted action of the miners.

The following table shows the total quantity and value of the phosphate rock produced in Florida since the beginning of the industry in 1888:

Output of phosphate rock in Florida, based on marketed product, from 1888 to 1901, inclusive.

Year.	Quantity.	Value.	Year.	Quantity.	Value.
	Long tons.			*Long tons.*	
1888	3,000	$21,000	1895	568,061	$2,112,902
1889	4,100	28,000	1896	495,199	1,547,353
1890	46,501	338,190	1897	552,342	1,493,515
1891	112,482	703,013	1898	600,894	1,847,796
1892	287,343	1,418,418	1899	726,420	2,804,061
1893	438,804	1,979,056	1900	706,243	2,983,312
1894	527,653	1,666,813	1901	751,996	3,159,473

The shipments of high-grade phosphate rock since 1894, as reported by Messrs. Auchincloss Brothers, will be found in the following table. The totals agree very closely with the statistics of production collected by the Geological Survey:

Total shipments of Florida hard-rock phosphate, by months, from 1894 to 1901, inclusive.

Month.	1894.	1895.	1896.	1897.	1898.	1899.	1900.	1901.
	Long tons.	*Long tons.*	*Long tons.*	*Long tons.*	*Long tons.*	*Long tons.*	*Long tons.*	*Long tons.*
January	16,526	15,780	16,996	12,924	11,682	28,560	23,359	17,673
February	4,111	17,252	16,853	20,668	26,850	32,630	28,623	32,412
March	34,126	31,283	37,155	37,243	34,049	43,051	25,232	44,751
April	36,533	41,445	36,559	32,608	22,274	59,001	52,398	35,945
May	30,780	45,053	45,846	45,715	31,992	48,584	44,598	33,349
June	29,818	31,027	16,511	32,837	31,948	23,051	21,950	23,039
July	46,855	21,284	15,296	22,639	53,114	48,747	38,822	28,791
August	37,823	14,588	19,914	19,292	27,409	41,155	21,491	57,497
September	34,032	25,388	25,116	59,966	46,961	35,728	20,711	51,781
October	19,732	27,783	30,605	27,664	21,476	36,694	26,171	49,093
November	7,683	18,160	38,402	20,184	30,595	28,947	24,222	30,326
December	6,060	17,003	23,618	18,537	22,155	18,527	20,976	19,473
Total	304,079	306,046	322,871	350,277	360,505	444,675	348,556	424,130

The following is the record of shipments to each country for the last seven years:

Shipments of Florida hard-rock phosphate, by countries, from 1895 to 1901, inclusive.

Country.	1895.	1896.	1897.	1898.	1899.	1900.	1901.
	Long tons.	*Long tons.*	*Long tons.*	*Long tons.*	*Long tons.*	*Long tons.*	*Long tons.*
England	27,007	20,533	24,163	23,849	31,789	20,542	28,790
Scotland	3,054	1,038	5,957	6,000	9,545	1,790	6,185
Ireland	3,867	513	2,953	3,420	....	5,852	5,175
Germany	145,377	151,461	181,355	186,731	243,887	208,422	214,280
Belgium	7,033	27,214	22,954	38,903	37,103	31,639	58,181
Holland[a]	52,724	47,235	53,039	64,309	87,167	54.349	72,158
Denmark	6,735	9,594	11,019	8,287	5,475	2,930	12,814
Norway and Sweden	9,304	12,534	7,442	9,378	11,938	8,000	....
France	23,534	6,986	13,931	....	3,165	....	6,498
Italy	21,615	32,999	16,931	11,040	4,546	....	5,842
Russia	....	1,607	3,613	....	1,700	2,702	....
Austria	3,871	2,494	4,505	4,946	....	5,922	8,114
Spain	....	....	....	....	....	2,500	2,600
United States, West Indies, Australia, Japan, Hawaii, etc.	1,925	8,663	2,415	3,642	8,360	3,908	3,493
Total	306,046	322,871	350,277	360,505	444,675	348,556	424,130

[a] A large proportion of the shipments to Rotterdam are forwarded to the interior of Germany.

Total shipments of Florida hard-rock phosphates from 1890 to 1901, inclusive.

Year.	Quantity.	Year.	Quantity.	Year.	Quantity.
	Long tons.		*Long tons.*		*Long tons.*
1890	11,206	1894	304,079	1898	360,505
1891	71,682	1895	306,046	1899	444,675
1892	188,013	1896	322,871	1900	348,556
1893	220,216	1897	350,277	1901	424,130

SOUTH CAROLINA.

The total production of phosphate rock in South Carolina since 1867 and the distribution of the shipments according to sources (land or river) are shown in the following table:

Output of phosphate rock by the land and river mining companies of South Carolina from 1867 to 1901, inclusive.

Year ending.	Land companies.	River companies.	Total.	Year ending.	Land companies.	River companies.	Total.
May 31—	*Long tons.*	*Long tons.*	*Long tons.*	Dec. 31—	*Long tons.*	*Long tons.*	*Long tons.*
1867	6	....	6	1885[a]	149,400	128,389	277,789
1868	12,262	....	12,262	1886	253,484	177,065	430,549
1869	31,958	....	31,958	1887	261,658	218,900	480,558
1870	63,252	1,989	65,241	1888	290,689	157,878	448,567
1871	56,533	17,655	74,188	1889	329,543	212,102	541,645
1872	36,258	22,502	58,760	1890	353,757	110,241	463,998
1873	33,426	45,777	79,203	1891	344,978	130,538	475,516
1874	51,624	57,716	109,340	1892	243,652	150,575	394,227
1875	54,821	67,969	122,790	1893	308,435	194,129	502,564
1876	50,566	81,912	132,478	1894	307,305	142,803	450,108
1877	36,431	126,569	163,000	1895	270,560	161,415	431,975
1878	112,622	97,700	210,322	1896	267,072	135,351	402,423
1879	100,779	98,586	199,365	1897	267,380	90,900	358,280
1880	125,601	65,162	190,763	1898	298,610	101,274	399,884
1881	142,193	124,541	266,734	1899	223,949	132,701	356,650
1882	191,305	140,772	332,077	1900	266,186	62,987	329,173
1883	219,202	159,178	378,380	1901	225,189	95,992	321,181
1884	250,297	181,482	431,779	Total..	6,456,896	3,862,240	10,319,136
1885	225,913	169,490	395,403				

[a] Seven months.

From the above table it appears that the total amount of land and river rock produced in South Carolina during the thirty-five years since the industry was started in that State has exceeded 10,000,000 long tons. The production of land rock in 1901 was 40,997 long tons less than that of 1900 practically, equaling the output for 1899. The production of river rock in 1901 increased 33,005 long tons over that of the preceding year; the total production was less than in any year since 1881, the conditions affecting the industry in Florida also influencing that of South Carolina, namely, the low price of superphosphates and the excessive ocean freight rates, which decreased foreign shipments. As reported by the American Fertilizer, there were no foreign shipments of phosphate rock from Charleston in 1901 (not including possible foreign shipments via the Atlantic Coast Line and the Plant system of railroads, which were not reported). The foreign shipments from Beaufort, as reported by the same authority, amounted to 45,709 long tons of South Carolina phosphate, as compared with the total foreign shipments from both ports of 47,752 long tons in 1900. Concurrent with this decrease in foreign shipments, the price of river rock showed a slight decline—from $2.61 per long ton in 1900 to $2.56 in 1901—and the price of land rock decreased from $3.30 in 1900 to $3.18 in 1901.

Quantity and value of phosphate rock produced in South Carolina from 1897 to 1901, inclusive, classified by grades.

Year.	Land rock.		River rock.		Total.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Long tons.		*Long tons.*		*Long tons.*	
1897	267,380	$748,050	90,900	$238,522	358,280	$986,572
1898	298,610	856,225	101,274	251,047	399,884	1,107,272
1899	223,949	738,969	132,701	339,130	356,650	1,078,099
1900	266,186	877,405	62,987	164,565	329,173	1,041,970
1901	225,189	716,101	95,992	245,739	321,181	961,840

TENNESSEE.

The production of phosphate rock in Tennessee began in 1894 with an output of 19,188 long tons, valued at $67,158. The industry followed the natural sequence of discovery: "Boom," collapse, and final establishment on a proper business basis. The improvement in conditions was manifest in 1899 and 1900, the latter year showing an output of 454,491 long tons, valued at $1,328,707. During 1901, however, the production on the sales basis decreased to 409,653 long tons, valued at $1,192,090. This decrease was due in part to the heavy rainfall during the summer months which flooded the works, and in part to the attitude of foreign superphosphate manufacturers, who withheld orders awaiting a fall in price. The production of phosphate rock during the last eight years in which phosphate mining has been carried on in the State is shown in the following table:

Production of phosphate rock in Tennessee from 1894 to 1901, inclusive.

Year.	Quantity.	Value.	Year.	Quantity.	Value.
	Long tons.			*Long tons.*	
1894	19,188	$67,158	1898	308,107	$498,392
1895	38,515	82,160	1899	424,109	1,177,160
1896	26,157	57,370	1900	454,491	1,328,707
1897	128,723	193,115	1901	409,653	1,192,090

OTHER STATES.

During 1901 Pennsylvania reported a marketed output of 893 long tons, valued at $3,000, as compared with 900 long tons, valued at $4,500, in 1900. There was no reported production of phosphate rock from Alabama, Arkansas, or North Carolina, although the shell rock quarry at Castle Haynes, N. C., has been operated for the last two years. The city of Wilmington is taking this entire output for macadamizing the streets. The estimated quantity of this material produced in 1901 was 20,000 long tons, as compared with 15,000 long tons in 1900. These quantities have not been included in the tables of production, as the rock, which is of extremely low grade, is not used for fertilizing purposes.

PRICES.

The average price for phosphate rock per ton realized at the mines during 1901, based on total output and value as deduced from the table given on p. 7, is as follows: The average price per long ton of Florida hard rock during 1901 continued practically the same as in the preceding year, being $5.23 as compared with $5.25 in 1900. This grade of product averaged $4.60 in 1899 and $3.81 in 1898. The continued increase in the production of land pebble has been accompanied with a decrease in the average price per ton, which was $2.91 in 1899, $2.77 in 1900, and $2.67 in 1901. These prices, however, are considerably in excess of the price in 1898, which averaged $1.89 per long ton. The decrease in the production of river pebble in 1901 was accompanied by a decrease in price, which averaged $2.25, as compared with $2.36 in 1900. The price of land rock in South Carolina during 1901 was $3.18 per long ton as compared with $3.30 in 1900 and 1899, and $2.87 in 1898. South Carolina river rock, for which the average price per long ton was $2.48 in 1898, $2.56 in 1899, and $2.61 in 1900, shows a slight decrease in 1901, falling to $2.56, which corresponds exactly to the price in 1899. The price of Tennessee phosphate rock, which advanced from an average of $1.62 in 1898 to $2.77 in 1899 and $2.92 in 1900, continued practically constant during 1901, the amount being $2.91. The chief reason for the advance in price of Tennessee rock in 1899 and 1900 was the improvement in the preparation of the material for the market and the consolidation of several large concerns operating in this region. This consolidation eliminated, to a considerable extent, the competition for trade which adversely affected prices during the preceding three or four years. In 1897 the average price per ton obtained for Tennessee rock was only $1.50, which in many cases was less than cost of production.

IMPORTS.

The following table shows the imports of fertilizers of all kinds into the United States from 1868 to 1901, inclusive:

Fertilizers imported and entered for consumption in the United States from 1868 to 1901, inclusive.

Year ending—	Guano.		Crude phosphates and other substances used for fertilizing purposes.		Total value.
	Quantity.	Value.	Quantity.	Value.	
June 30—	*Long tons.*		*Long tons.*		
1868	99,668	$1,336,761	....	$88,864	$1,425,625
1869	13,480	217,004	....	61,529	278,533
1870	47,747	1,414,872	....	90,817	1,505,689
1871	94,344	3,313,914	....	105,703	3,419,617
1872	15,279	423,322	....	83,342	506,664
1873	6,755	167,711	....	218,110	385,821
1874	10,767	261,085	....	243,467	504,552
1875	23,925	539,808	....	212,118	751,926
1876	19,384	710,135	....	164,849	874,984
1877	25,580	873,459	....	195,875	1,069,334
1878	23,122	849,607	....	285,089	1,134,696
1879	17,704	634,546	....	223,283	857,829
1880	8,619	108,733	....	317,068	425,801
1881	23,452	399,552	....	918,835	1,318,387
1882	46,999	854,463	133,956	1,437,442	2,291,905
1883	25,187	537,080	96,586	798,116	1,335,196
1884	28,090	588,033	35,119	406,233	994,266
1885	20,934	393,039	40,068	611,284	1,004,323
Dec. 31—					
1886	13,520	306,584	82,608	1,179,724	1,486,308
1887	10,195	252,265	53,100	644,301	896,566
1888	7,381	125,112	36,405	329,013	454,125
1889	15,991	313,956	35,661	403,205	717,161
1890	4,642	59,580	31,191	252,787	312,367
1891	11,937	199,044	29,743	214,671	413,715
1892	3,073	46,014	92,476	666,061	712,075
1893	5,856	97,889	106,549	718,871	816,760
1894	5,757	105,991	126,820	904,247	1,010,238
1895	4,270	51,642	80,088	450,379	502,021
1896	6,532	79,815	113,955	639,858	719,673
1897	4,930	55,715	200,598	970,836	1,026,551
1898	4,482	50,783	139,472	720,053	770,836
1899	2,700	27,000	150,902	906,181	933,181
1900	5,161	38,184	202,605	1,382,734	1,420,918
1901	7,820	89,202	265,376	1,501,559	1,590,761

WORLD'S PRODUCTION.

In the following table will be found a statement of the world's production of phosphate rock from 1896 to 1900:

World's production of phosphate rock from 1896 to 1900.

[Metric tons.]

Country.	1896.		1897.		1898.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Algeria	165,738	$500,905	228,141	$912,564	269,500	$1,078,000
Belgium	[a] 297,470	537,320	[a] 350,056	436,762	[a] 156,920	303,230
Canada	517	3,420	824	3,984	665	3,665
France	582,667	3,502,027	535,390	2,852,887	568,558	3,115,958
Norway	1,106	17,280	872	12,960	3,593	53,352
Redonda (Br. West Indies)	....	....	812	5,525	750	4,725
Russia	3,776	11,065	5,917	22,132	1,870	4,784
Spain	770	3,080	2,084	16,672	4,500	46,003
United Kingdom	3,048	26,250	2,032	17,500	1,575	13,565
United States	945,982	2,803,372	1,056,322	2,673,202	1,330,264	3,453,460

Country.	1899.		1900.	
	Quantity.	Value.	Quantity.	Value.
Algeria	324,983	$1,299,932	319,422	$1,277,688
Belgium	[a] 190,090	342,180	[a] 215,670	367,164
Canada	2,722	18,000	1,415	7,105
France	645,868	3,334,145	587,919	2,827,291
Norway	1,500	22,140	(b)	....
Redonda (British West Indies)	1,507	9,270	2,230	13,720
Russia	16,863	58,640	(b)	....
Spain	3,510	35,100	4,170	18,590
United Kingdom	1,469	12,645	630	5,425
United States	1,540,506	5,084,076	1,515,573	5,359,248

[a] Cubic meters.

[b] Statistics not yet available.

GREENSAND MARL.

By Arthur L. Parsons.

OCCURRENCE.

The use of greensand marl as a fertilizer has long been recognized as an important factor in the improvement of the soils of certain portions of this country and of Europe, but the extent of the deposits is not a matter of common knowledge. The deposits in the United States that are best known and have been most extensively developed are the marl beds of New Jersey. These beds, which belong to the Upper Cretaceous and Eocene formations, are to be found outcropping in a strip extending in a northeast and southwest direction from Raritan Bay to the Delaware River. The northwestern limit of this region may be marked by a line extending from South Amboy through Jamesburg, Cranbury, and Hightstown to Bordentown on the Delaware River, and from this point following the river as far south as Salem. The southeastern boundary is not so well defined as the northwestern border, but passes near Woodstown, Mullica Hill, Buddstown, Farmingdale, and Deal Beach on the Atlantic Ocean, from which point it extends along the coast to South Amboy. The total length of this region is about 100 miles, and its greatest width is about 19 miles, though at its narrowest point it is only about 9 miles across. The estimated area is about 1,200 square miles.

South of this region, the marl has been found in boring artesian wells, and from the data known it is safe to assert that all of southern New Jersey is underlain by this formation. At Lakewood it is found at a depth of about 400 feet, which would be equivalent to a depth of 200 to 250 feet below sea level. At Atlantic City the thickness of the overlying strata is said to be about 800 feet.

The surface of this country is comparatively level, the highest elevation being little more than 200 feet, and all the hills are caused by the denuding action of subaerial agencies. As a rule the outcrops of the marl are found only in the valleys and in all other places are overlain by from 50 to 100 feet of overburden, in consequence of which only those portions of the deposits lying near streams are utilized.

The marl deposits consist of several beds or strata dipping to the southeast which were deposited conformably on the underlying strata and have undergone little, if any, change in dip during the upheaval which brought them above the ocean level, as the observed angle of dip is only about 38 feet per mile and the slope of the ocean bottom near the shore of southern New Jersey does not vary greatly from this angle.

The divisions of the greensand formation as determined by the New Jersey Geological Survey are shown in the following table which correlates the divisions given in Mr. Cook's report (1868) and those determined by Dr. W. B. Clark, 1897:

Classification of greensand formation in New Jersey.

Cook's classification.			*Clark's classification.*	
Upper marl bed	Blue marl		Shark River	Eocene.
	Ash marl		Manasquan	Upper Cretaceous.
	Green marl			
Yellow sand	Yellow sand		Rancocas	
Middle marl bed	Yellow limestone and lime-sand			
	Shell layer			
	Green marl			
	Chocolate marl			
Red sand	Indurated green earth	Redbank sands	Monmouth	
	Red sand			
	Dark micaceous clay			
Lower marl bed	Marl and clay	Navesink marls		
	Blue shell marl			
	Sand marl	Mt. Laurel sands		
Clay marls	Laminated sands		Matawan	
	Clay containing green sand			
Plastic clay	Lignite		Raritan	
	Potter's clay			
	Lignite			

As might naturally be expected from the dip of these strata the lowest is found farthest north, and the region where its outcrops are to be found is characterized by a soil intermediate between a sandy loam and a clay loam. With but few exceptions, these clay marls are considered of little value and have not been developed. The lower and middle marl beds have been extensively developed in the past, but of late the product has found only a local market and the tendency at present is to use only such marl as is found on the property of the consumer.

The continuation of these deposits through Delaware, Maryland, and Virginia offers an inexhaustible supply of this material, which has been utilized only to a slight extent. The northern border extends from a point about 2 miles north of Delaware City through Chesapeake City to Chesapeake Bay at the mouth of the Sassafras River.

On the west side of Chesapeake Bay the boundary is more irregular, but extends in a nearly direct line from Bodkin Point to the Potomac River at a point near Fort Washington, thence along the Potomac to Marlboro Point on the Virginia side of the river. A narrow deposit exists near the river on the Virginia side between this point and Mathias Point, but the main body of these deposits lies east of a north and south line from Mathias Point to the North Carolina line. The eastern boundary of the Virginia deposits is unknown, but the southern boundary of the Maryland and Delaware deposits is marked by an irregular line extending from Popes Creek on the Potomac through Brandywine and Nottingham to Tracys on Herring Bay. On the east side of Chesapeake Bay the border is approximately a straight line from Norman on Kent Island through Rolphs and Millington, Md., and Townsend, Del., to Port Penn on the Delaware River.

PRODUCTION.

Throughout the greater part of the marl region from New Jersey to North Carolina some use has been made of this material as a fertilizer, and though the application of a dressing of marl is almost universally conceded to be beneficial to the soil, the amount now used is much less than formerly. The entire output last year was from New Jersey and Virginia, and by far the larger portion was from New Jersey. The total estimated production was 99,880 tons and the estimated value was $124,880.

USE.

A striking difference in the use of the marl is shown in the producing States; the entire product from New Jersey is applied to the soil in the natural state, but the Virginia product is dried and ground for use in commercial fertilizers. In either case its value as a fertilizer depends upon the quantity of lime, phosphoric acid, and potash present.

The following analyses show the composition of characteristic marls from New Jersey, Maryland, and Virginia:

Analyses of marls from New Jersey, Maryland, and Virginia.

Constituent.	1.	2.	3.	4.	5.	6.	7.	8.
P_2O_5	1.14	1.33	1.02	2.24	2.69	2.56	3.58	3.87
SO_3	.14	....	.27	.39	.26	.22	.97	.31
SiO_2	38.70	46.03	50.23	50.80	49.40	51.50	53.15	54.75
CO_2	6.13	....	....	....	....	....	....	....
K_2O	3.65	5.67	6.32	5.18	6.31	4.62	3.75	4.11
CaO	9.07	2.01	1.40	2.13	2.52	1.26	3.27	5.46
MgO	1.50	3.47	3.45	3.54	3.24	3.95	1.75	2.99
Al_2O_3	10.20	7.86	7.94	8.77	8.90	6.01	8.79	6.46
Fe_2O_3	18.63	25.23	20.14	17.63	17.11	21.04	15.94	15.20
H_2O	10.00	8.40	9.00	9.66	9.10	7.39	8.98	6.85
	99.16	100.00	99.77	100.34	99.53	98.55	100.18	100.00

Constituent.	9.	10.	11.	12.	13.	14.	15.
P_2O_5	2.58	2.30	....	0.09	0.13	0.80	....
SO_3	1.89	.00	....	....	....	3.18	....
SiO_2	59.80	57.67	60.87	21.58	49.08	69.60	63.94
CO_2	....	....	3.17	29.79	.55	....	3.53
K_2O	4.25	3.53	.77	.37	.39	2.66	.61
Na_2O	....	....	.23	.59	.42	Trace.	.31
CaO	2.97	1.26	1.66	36.78	....	1.21	2.50
MgO	2.00	3.67	2.77	1.05	.76	.80	2.06
Al_2O_3	6.00	10.10	22.68	7.70	41.25	12.85	21.50
Fe_2O_3	11.98	14.16				4.17	
H_2O	8.32	7.25	3.58	.76	1.31	4.57	3.11
Volatile	....	....	2.84	.21	6.27		2.60
	99.79	99.94	98.57	98.92	100.16	99.84	100.16

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13. Winchester, Md., Eocene, Peter Fireman, analyst, U. S. Geol. Surv., Bull. 141.
14. City Point, Va., Eocene or Miocene, H. Froehling, chemist.
15. Evergreen, Va., Eocene or Miocene, Peter Fireman, analyst, U. S. Geol. Surv., Bull. No. 141.

The use of marl in the manufacture of commercial fertilizer, however, does not depend upon the value of the fertilizing elements contained so much as upon the ease with which it may be prepared for use. Most people who understand the manufacture and use of commercial fertilizer, know that the manufacturers expect to sell their product at a fair price for the available fertilizing ingredients, so that the purchaser of a high-grade fertilizer actually pays no more per ton for what he uses than does the man who buys a low-priced but also low-grade fertilizer. The use of marl as a filler has the advantage over other materials used in that it has in itself ingredients that in time, by decomposition, become valuable, and because, in addition, its first cost is no greater than that of other fillers which do not furnish these fertilizing ingredients.

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SULPHUR AND PYRITE.

By Joseph Struthers.

SULPHUR.

PRODUCTION.

The production of sulphur in the United states during 1901 was 7,690 short tons, valued at $223,430, which was derived from Nevada, Idaho, Utah, and Louisiana, in the order of the importance of their output. A comparison with the production during 1900 of 3,525 short tons, valued at $88,100, shows an increase during 1901 of 4,165 tons in quantity and $135,330 in value. It is worthy of note that Nevada and Oregon reentered the list of producing States during 1901. The quantity of sulphur produced in the United States has always been of insignificant proportions as compared with the total consumption of the country. During 1901 the quantity of sulphur consumed in the United States from domestic and foreign sources, including the sulphur content of iron pyrite which is used in the manufacture of sulphuric acid, amounted to 525,745 short tons.

The production of sulphur in the United Statēs during 1901 is the largest that has ever been recorded and indicates that the development of this important branch of the mineral industry is worthy of considerable attention. In recent years the domestic production of sulphur has amounted to less than 1 per cent of the total consumption, but for 1901 the percentage was slightly larger.

The following table shows the annual production of sulphur in the United States since 1880:

Sulphur production of the United States from 1880 to 1901, inclusive.

Year.	Quantity.	Value.	Year.	Quantity.	Value.
	Short tons.			*Short tons.*	
1880	600	$21,000	1885	715	$17,875
1881	600	21,000	1886	2,500	75,000
1882	600	21,000	1887	3,000	100,000
1883	1,000	27,000	1888	....	....
1884	500	12,000	1889	450	7,850

Sulphur production of the United States from 1880 to 1901, inclusive—Continued.

Year.	Quantity.	Value.	Year.	Quantity.	Value.
	Short tons.			*Short tons.*	
1890	....	....	1896	5,260	$87,200
1891	1,200	$39,600	1897	2,275	45,590
1892	2,688	80,640	1898	1,200	32,960
1893	1,200	42,000	1899	4,830	107,500
1894	500	20,000	1900	3,525	88,100
1895	1,800	42,000	1901	7,690	223,430

DOMESTIC CONSUMPTION.

In considering the consumption of sulphur it is necessary to include the quantity of iron pyrite used in the manufacture of sulphuric acid. The use of iron pyrite for this purpose has shown a remarkable increase in the last ten years. Accurate statistics in regard to the consumption of iron pyrite prior to 1891 are not available, as the statistics of imports previous to that year did not separate the pyrite imported for this purpose. Prior to 1884 pyrite was included among other sulphur ores in the statistics compiled by the Bureau of Statistics of the Treasury Department. From 1884 to 1887 pyrite ores were separately reported, but the small quantities reported indicate that a considerable quantity was imported either under the former classification of sulphur ore or as iron ore, under which it was classified from 1887 to 1891, unless it contained copper exceeding 3.5 per cent. A comprehensive review of the growth of the consumption of sulphur and pyrite must therefore necessarily begin with 1891, the year in which the total quantity of sulphur used (imported and domestic) was 118,258 long tons. The sulphur content of the iron pyrite consumed in 1891 was 93,233 long tons, making a total of 211,491 long tons. In 1901 the domestic production of sulphur amounted to 6,866 long tons and the imports to 175,210 long tons, a total of 182,076 long tons. In this year the sulphur content of the imported pyrite amounted to 181,668 long tons, and that from the domestic production of pyrite was 105,671 long tons, making a total of 287,339 long tons, or more than three times the quantity consumed in 1891. The use of iron pyrite as a raw material in place of sulphur for the manufacture of sulphuric acid continues to increase steadily. By far the greater part of the sulphur consumed in the United States is used in the manufacture of paper stock by the sulphite process. The wood pulp is digested under pressure with sulphurous acid or the acid sulphite of calcium and magnesium, which, reacting upon the lignin and other incrusting material of the fiber, transforms them into soluble products subsequently removed in the liquor.

The statistics of production and imports of sulphur and of the sulphur content of domestic and imported pyrite, exhibiting together the total domestic consumption, are presented in the following table:

Estimated consumption of sulphur in the United States from 1891 to 1901, inclusive.

Source.	1891.	1892.	1893.	1894.	1895.
	Long tons.	*Long tons.*	*Long tons.*	*Long tons.*	*Long tons.*
Sulphur:					
Domestic	1,071	2,400	1,071	446	1,607
Imported[a]	117,187	101,122	105,823	125,459	122,096
Sulphur content of pyrite:[b]					
Domestic	47,911	49,405	34,100	47,673	44,697
Imported	45,292	68,561	87,715	74,596	85,796
Total domestic consumption	211,491	221,488	228,709	248,174	254,196

Source.	1896.	1897.	1898.	1899.	1900.	1901.
	Long tons.	*Long tons.*	*Long tons.*	*Long tons.*	*Long tons.*	*Long tons.*
Sulphur:						
Domestic	4,696	2,031	1,071	4,300	3,147	6,866
Imported[a]	139,280	141,905	164,504	141,533	167,696	175,210
Sulphur content of pyrite:[b]						
Domestic	51,968	64,440	87,014	78,630	92,077	105,671
Imported	90,076	116,796	113,748	121,441	145,118	181,668
Total domestic consumption	286,020	325,172	366,337	345,904	408,038	469,415

[a] Includes crude sulphur, flowers of sulphur, refined sulphur, and sulphur lac.

[b] Based on average sulphur content of 45 per cent.

PRODUCTION OF SULPHUR IN ITALY.

In the following table the statistics of the quantity and value of the sulphur produced in Italy since 1860 (practically all of which is from the island of Sicily) are taken from the official report Rivista del Servizio Minerario:

Production of sulphur in Italy from 1860 to 1900, inclusive.

Year.	Quantity.	Value.	Year.	Quantity.	Value.
	Long tons.			*Long tons.*	
1860	155,067	$3,693,036	1875	204,086	$5,562,575
1861	163,217	3,865,950	1876	271,605	6,372,385
1862	162,825	3,872,376	1877	256,141	5,184,313
1863	179,637	4,273,992	1878	300,238	5,896,665
1864	177,707	4,134,870	1879	370,268	7,040,165
1865	168,829	3,756,507	1880	353,883	7,037,859
1866	195,019	4,579,547	1881	367,163	8,088,237
1867	195,873	4,641,046	1882	438,751	9,002,010
1868	198,097	4,822,158	1883	439,332	8,181,887
1869	197,493	5,071,715	1884	404,431	7,048,751
1870	200,597	4,702,716	1885	418,708	6,748,077
1871	196,518	4,869,515	1886	368,327	5,396,720
1872	235,323	5,746,251	1887	336,715	4,572,979
1873	269,794	6,566,050	1888	370,486	4,827,512
1874	247,221	6,813,675	1889	365,524	4,758,005

Production of sulphur in Italy from 1860 to 1900, inclusive—Continued.

Year.	Quantity.	Value.	Year.	Quantity.	Value.
	Long tons.			*Long tons.*	
1890	363,305	$5,455,201	1896	419,501	$5,919,554
1891	389,171	8,593,413	1897	488,676	8,680,800
1892	411,828	7,569,781	1898	494,278	9,368,268
1893	410,958	5,716,018	1899	554,638	10,392,415
1894	399,260	4,876,715	1900	535,522	10,212,903
1895	364,807	3,989,877			

EXPORTS OF SULPHUR FROM SICILY.

In connection with the foregoing statistics, the following table, showing the exports of sulphur from Sicily and the countries to which exported during the last five years, will be found of interest. This table is compiled from the annual statement published by Mr. Alfred S. Malcolmson, of New York.

Total exports of sulphur from Sicily from 1896 to 1901, inclusive.

Country.	1896.	1897.	1898.	1899.	1900.	1901.
	Tons.	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*
United States	124,923	118,137	138,435	128,441	162,505	144,817
France	76,739	84,895	88,657	96,043	103,647	74,394
Italy	54,009	73,052	62,652	87,230	101,073	74,516
United Kingdom	21,913	24,520	26,983	25,038	23,973	22,464
Greece and Turkey	18,556	13,866	24,808	18,656	19,647	21,702
Portugal	12,001	7,054	8,257	12,269	10,937	11,335
Russia	18,752	17,532	12,285	19,211	22,090	15,110
Germany	15,680	19,721	27,048	25,933	28,702	23,448
Austria	13,799	15,993	15,796	18,519	21,594	18,842
Spain	5,910	4,039	3,233	7,757	6,187	2,979
Belgium	7,527	9,253	8,402	7,481	9,721	7,471
Holland	3,834	3,599	5,646	6,408	18,595	10,848
Sweden and Denmark	14,540	11,226	12,331	12,476	22,681	24,486
Other countries	8,562	7,651	12,791	13,569	6,810	9,887
Total	396,745	410,538	447,324	479,031	558,162	462,299

The following table shows the total exports from Sicily from 1883 to 1901, inclusive:

Total exports of sulphur from Sicily from 1883 to 1901, inclusive.

Year.	Tons.	Year.	Tons.	Year.	Tons.
1883	335,392	1890	344,763	1897	410,538
1884	314,058	1891	293,323	1898	447,324
1885	314,582	1892	309,536	1899	479,031
1886	329,446	1893	349,192	1900	558,162
1887	311,302	1894	328,930	1901	462,299
1888	347,775	1895	347,636		
1889	351,451	1896	396,745		

PORTS IN UNITED STATES RECEIVING SICILIAN SULPHUR.

The ports in the United States to which such shipments were made, together with the quantity shipped to each since 1896, and the total imports since 1883, are shown in the following tables:

Ports in the United States receiving Sicilian sulphur and the quantity received by each.

Port.	1896.	1897.	1898.	1899.	1900.	1901.
	Tons.	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*
New York	68,353	70,474	72,989	83,396	94,753	91,735
Charleston	7,700	5,130	2,100			
Philadelphia	6,000	5,409	6,600	10,740	6,700	11,895
Baltimore	14,150	13,831	14,365	12,400	12,200	10,450
Boston	5,300	8,220	6,050	1,600	4,000	6,697
Wilmington, N. C	2,660	1,550	1,700			
Savannah	9,395	4,700	1,980		1,750	
Port Royal	660					
San Francisco	3,125		2,539			
New Orleans	2,100	3,340	2,500	800	3,000	1,400
Portland, Me	2,550	4,343	13,750	18,915	27,612	21,990
Norfolk	2,930	1,140				
Canada			12,692		7,250	650
Other ports			2,070	590	5,240	
Total	124,923	118,137	138,435	128,441	162,505	144,817

Total imports of Sicilian sulphur since 1883.

Year.	Tons.	Year.	Tons.	Year.	Tons.
1883	96,629	1890	106,656	1897	118,137
1884	94,929	1891	97,520	1898	138,435
1885	99,378	1892	84,850	1899	128,441
1886	98,590	1893	83,901	1900	162,505
1887	89,419	1894	105,773	1901	144,817
1888	128,265	1895	99,227		
1889	109,008	1896	124,923		

The quality of Sicilian sulphur imported in each year since 1887 has been as follows:

Quality of Sicilian sulphur received at the different ports of the United States since 1887.

Port.	1887.		1888.		1889.		1890.		1891.	
	Best unmixed seconds.	Best thirds.	Best unmixed seconds.	Best thirds.	Best unmixed seconds.	Best thirds.	Best unmixed seconds.	Best thirds.	Best unmixed seconds.	Best thirds.
	Tons.	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*
New York..........	29,919	16,060	35,573	25,133	32,983	22,956	20,801	16,589	29,358	19,665
Charleston.........	8,875	5,449	15,485	7,011	6,325	6,074	20,873	6,690	17,196	4,450
Philadelphia.......	2,127	9,637	3,050	8,743	2,000	12,334	1,000	10,094	450	6,406
Baltimore..........	4,463	5,843	11,380	5,950	7,656	7,660	5,930	10,770	4,510	6,855
Boston.............	200	3,100	700	5,600	750	4,200	200	2,300	1,300	650
Savannah..........	....	....	2,130	1,415	2,790	1,450	2,750	3,170	850	700
Wilmington, N. C ..	1,020	....	2,355	....	2,040	....	1,309	....	1,900	700
Other ports........	106	2,620	1,500	2,240	200	590	1,540	2,640	1,200	1,330
Total.........	46,710	42,709	72,173	56,092	54,744	55,264	54,403	52,253	56,764	40,756

Port.	1892.		1893.		1894.		1895.		1896.	
	Best unmixed seconds.	Best thirds.	Best unmixed seconds.	Best thirds.	Best unmixed seconds.	Best thirds.	Best unmixed seconds.	Best thirds.	Best unmixed seconds.	Best thirds.
	Tons.	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*
New York..........	34,390	14,700	29,146	14,250	33,150	13,725	35,888	19,975	50,557	17,796
Charleston.........	4,010	500	11,665	1,860	3,273	12,023	700	8,450	2,330	5,370
Philadelphia.......	3,600	6,800	1,900	6,260	350	5,050	1,200	7,150	500	5,500
Baltimore..........	900	11,455	2,050	7,900	600	14,700	1,100	8,620	3,650	10,500
Boston.............	1,825	1,500	500	....	1,017	3,300	2,350	2,600	4,600	700
Savannah..........	600	570	3,450	1,880	5,695	4,100	3,784	800	8,370	1,025
Wilmington, N. C ..	....	....	....	1,140	....	1,890	....	650	1,260	1,400
New Orleans.......	....	....	1,900	....	2,400	....	1,700	....	2,100	....
Portland, Me.......	....	....	....	....	....	....	1,300	....	2,550	....
Other ports........	4,000	....	....	....	800	3,700	580	2,380	5,425	1,290
Total.........	49,325	35,525	50,611	33,290	47,285	58,488	48,602	50,625	81,342	43,581

Quality of Sicilian sulphur received at the different ports of the United States, etc.—Cont'd.

Port.	1897.		1898.		1899.		1900.		1901.	
	Best unmixed seconds.	Best thirds.	Best unmixed seconds.	Best thirds.	Best unmixed seconds.	Best thirds.	Best unmixed seconds.	Best thirds.	Best unmixed seconds.	Best thirds.
	Tons.	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*
New York	57,174	13,300	49,614	22,475	56,746	26,650	70,446	24,307	72,104	19,631
Charleston	1,500	3,630	500	1,600	....	....	....	....	....	....
Philadelphia	199	5,210	1,200	5,400	2,740	8,000	1,600	5,100	2,300	9,595
Baltimore	3,798	10,033	2,350	12,015	3,800	8,600	6,800	5,400	7,550	2,900
Boston	7,220	1,000	4,500	1,550	600	1,000	1,500	2,500	3,497	3,200
Savannah	4,700	....	1,980	....	....	....	1,750	....	....	....
Wilmington, N. C.	....	1,550	500	1,200	....	....	....	....	....	....
New Orleans	3,340	....	500	2,000	....	800	....	3,000	....	1,400
Portland, Me	4,343	....	13,750	....	18,915	....	27,612	....	21,990	....
Other ports	540	600	14,101	3,200	590	....	12,490	....	650	....
Total	82,814	35,323	88,995	49,440	83,391	45,050	122,198	40,307	108,091	36,726

PRICES OF SICILIAN SULPHUR.

Mr. Alfred S. Malcolmson has furnished the Survey with the following statement of the prices of Sicilian sulphur, best unmixed seconds, ex steamer at New York, for each month during 1897, 1898, 1899, 1900, and 1901. The wide variation between the extremes of prices in April and May, 1898, was due to the war with Spain. In each case the lower figure was for sulphur sold previously for April and May delivery. The higher prices were for spot sulphur after hostilities began and before the syndicate could make arrangements for shipping.

Spot prices for Sicilian sulphur, per long ton, ex steamer at New York.

Date.	1897.	1898.	1899.	1900.	1901.
January	$20.00 @ $20.50	$20.50	$21.00 @ $21.25	$21.00 @ $21.50	$21.25 @ $21.50
February	19.75	20.50	21.00	21.50 @ 21.75	21.25 @ 21.50
March	20.00	21.50	22.00 @ 22.50	21.50 @ 22.00	21.25 @ 21.50
April	19.25 @ 19.50	$21.50 @ 35.00	21.00	21.00 @ 21.50	20.75 @ 21.25
May	19.25 @ 19.50	21.75 @ 32.00	20.50 @ 21.00	20.75 @ 21.00	21.00 @ 21.25
June	19.25	24.00	20.75 @ 21.00	20.50 @ 21.00	21.50 @ 22.00
July	19.75	22.00	20.50	21.00 @ 21.50	21.50 @ 21.75
August	20.00	21.00	20.50	21.75 @ 22.50	21.75 @ 22.25
September	21.00	20.50 @ 21.00	20.50	22.00 @ 22.50	22.00 @ 22.75
October	21.00	21.00 @ 22.00	21.00	22.75 @ 23.00	22.75 @ 23.00
November	21.00	21.00 @ 21.50	21.00	21.25 @ 21.50	22.75 @ 23.00
December	20.75	21.00	21.25	20.75 @ 21.00	22.50 @ 23.25

IMPORTS.

The following statements, showing the quantity and value of sulphur imported into the United States for a series of years, are obtained from the Bureau of Statistics of the Treasury Department:

Sulphur imported and entered for consumption in the United States, 1867 to 1901, inclusive.

Year ending—	Crude.		Flowers of sulphur.		Refined.		All other.[a]		Total value.
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	
June 30—	*Long tons.*		*Long tons.*		*Long tons.*		*Long tons.*		
1867	24,544	$620,373	110	$5,509	251	$10,915	....	....	$636,797
1868	18,151	446,547	16	948	65	2,721	....	....	450,216
1869	23,590	678,642	97	4,576	645	27,149	....	....	710,367
1870	27,380	819,408	76	3,927	157	6,528	....	$1,269	831,132
1871	36,131	1,212,448	66	3,514	92	4,328	....	754	1,221,044
1872	25,380	764,798	36	1,822	57	2,492	....	....	769,112
1873	45,533	1,301,000	55	2,924	36	1,497	....	....	1,305,421
1874	40,990	1,260,491	51	2,694	57	2,403	....	....	1,265,588
1875	39,683	1,259,472	18	891	....	....	....	....	1,260,363
1876	46,435	1,475,250	41	2,114	44	1,927	....	....	1,479,291
1877	42,963	1,242,888	116	5,873	1,171	36,962	....	....	1,285,723
1878	48,102	1,179,769	159	7,628	150	5,935	....	....	1,193,332
1879	70,370	1,575,533	138	6,509	69	2,392	....	....	1,584,434
1880	87,837	2,024,121	124	5,516	158	5,262	....	....	2,034,899
1881	105,097	2,713,485	98	4,226	71	2,555	....	....	2,720,266
1882	97,504	2,627,402	159	6,926	59	2,196	....	....	2,636,524
1883	94,540	2,288,946	79	3,262	115	4,487	....	....	2,296,695
1884	105,112	2,242,697	178	7,869	126	4,765	....	....	2,255,331
1885	96,839	1,941,943	121	5,351	114	4,060	....	....	1,951,354
1886	117,538	2,237,989	213	8,739	116	3,877	....	....	2,250,605
1887	96,882	1,688,360	279	9,980	84	2,383	....	....	1,700,723
Dec. 31—									
1888	98,252	1,581,583	128	4,202	27	734	....	....	1,586,519
1889	135,933	2,068,208	15	1,954	10	299	....	....	2,070,461
1890	162,674	2,762,953	12	1,718	103	3,060	....	....	2,767,731
1891	116,971	2,675,192	206	6,782	10	1,997	....	....	2,683,971
1892	100,938	2,189,481	158	5,439	26	4,106	....	....	2,199,026
1893	105,539	1,903,198	241	5,746	43	1,017	....	....	1,909,961
1894	125,241	1,703,265	173	4,145	45	1,207	....	....	1,708,617
1895	121,286	1,546,481	581	12,888	229	4,379	....	50,006	1,613,754
1896	138,168	1,967,454	665	13,266	447	8,226	....	183,683	2,172,629
1897	136,563	2,395,436	....	....	....	....	5,342	58,637	2,454,073
1898	151,225	2,891,767	507	14,548	163	4,396	12,609	159,213	3,069,924
1899	140,182	2,484,801	335	9,917	184	4,519	832	23,966	2,523,203
1900	166,825	2,917,172	628	17,437	243	6,279	....	....	2,940,888
1901	174,194	3,261,397	748	20,201	268	6,308	....	....	3,287,906

[a] Includes sulphur lac and other grades not otherwise provided for, but not pyrite.

Statement, by countries and by customs districts, showing the imports into the United States of crude sulphur or brimstone each fiscal year from 1899 to 1901, inclusive.

Countries whence exported and customs districts through which imported.	1899.		1900.		1901.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
COUNTRY.	*Long tons.*		*Long tons.*		*Long tons.*	
Canada	5,098	$127,960	....	....	933	$24,957
England	5,163	109,381	7,425	$155,882	7,484	156,205
Italy	114,051	2,050,078	138,011	2,369,037	139,492	2,474,684
Japan	4,328	81,818	9,958	186,847	11,798	219,193
Other countries	43	1,212	5	146	4	65
Total	128,683	2,370,449	155,399	2,711,912	159,711	2,875,104
DISTRICT.						
Baltimore, Md	15,276	262,146	12,798	213,893	9,040	153,664
Boston and Charlestown, Mass	9,596	188,519	10,023	203,014	11,048	217,274
Champlain, N. Y	1,546	38,915	....	....	....	....
New Orleans, La	2,588	51,652	1,000	16,111	2,213	54,694
New York, N. Y	61,476	1,098,389	85,885	1,467,947	89,756	1,585,084
Philadelphia, Pa	8,611	151,065	7,448	120,284	11,100	185,319
Portland, Me	16,450	309,948	24,880	436,692	20,039	363,473
San Francisco, Cal	5,371	99,767	8,237	152,335	9,359	172,176
Savannah, Ga	....	....	751	13,675	1,000	18,190
Vermont, Vt	1,161	29,204	....	....	439	12,285
Willamette, Oregon	3,001	56,871	1,630	33,134	2,087	40,515
All other	3,607	83,973	2,747	54,827	3,630	72,430
Total	128,683	2,370,449	155,399	2,711,912	159,711	2,875,104

WORLD'S PRODUCTION.

World's production of sulphur for 1899 and 1900.

Country.	1899.		1900.	
	Quantity.	Value.	Quantity.	Value.
	Metric tons.		*Metric tons.*	
United States	4,383	$107,500	3,199	$88,100
Austria [a]	555	1,526	862	2,256
France [a]	11,744	28,884	11,551	26,427
Germany	1,663	36,000	1,420	30,400
Greece	1,237	22,266	891	16,038
Hungary	116	3,600	123	3,820
Italy	554,638	10,392,415	544,119	10,212,903
Japan	10,235	211,735	14,435	298,660
Russia	451	9,412	....	....
Spain	1,100	31,350	750	18,000
Sweden	....	....	70	1,890
Total	586,122	10,844,688	577,420	10,698,494

[a] Crude rock.

PYRITE.

PRODUCTION.

On account of the continued prosperous trade throughout the United States during 1901 the production of pyrite was stimulated to the largest yearly quantity yet recorded, amounting to 234,825 long tons, valued at $1,024,449. A comparison with the production during 1900 of 204,615 long tons, valued at $749,991, shows an increase in quantity of 30,210 long tons (14.8 per cent), and in value of $274,458 (36.6 per cent). The greater part of the output was derived from Virginia, Colorado, Massachusetts, and New York, in the order of production. Ohio contributed 7,585 long tons of pyrite, which was obtained as so-called "coal brasses" from the coal mined in this State, and North Carolina, which produced 5,000 long tons of pyrite in 1900, reported no production during 1901. No new mines of importance were opened during the year, although development work was carried on in localities which have long been known as probable producers, notably in New York, Virginia, and North Carolina. In addition to the large increase in the production of pyrite in the United States during 1901 there was a very large increase in the quantity of pyrite imported, the statistics of imports for 1901 and 1900 being, respectively, 403,706 long tons ($1,415,149), and 322,484 long tons ($1,055,121). Since 1891 the annual import of pyrites has exceeded the domestic production.

In the United States the purchase of all domestic and foreign pyrites and other ores used for the sulphur content is practically in the hands of four trade combinations, and, as the total purchases amount annually to about 500,000 tons, stocks of foreign ores can be accumulated at the seaboard and shipped inland in quantities to secure lowest freight rates. These conditions favor the importation of foreign ores and leave but little incentive to develop domestic mines of uncertain character.

Assuming that the stocks carried forward from one year to another are practically the same, and estimating the domestic consumption by combining the imports and the domestic production, it will be seen that the quantity of iron pyrite consumed in this country in 1901 was 638,531 long tons as compared with 527,099 long tons in 1900 and 444,602 long tons in 1899. Notwithstanding the large increases in both the production and the imports of pyrite in 1901, the price of the domestic product advanced from $3.67 per ton in 1900 to $4.36 per ton in 1901. In a similar manner the value of the pyrite imported increased from $3.27 per ton in 1900 to $3.51 per ton in 1901.

The quantity and value of pyrite mined for the sulphur content in the United States since 1882 have been as follows:

Production of pyrite in the United States from 1882 to 1901, inclusive.

Year.	Quantity.	Value.	Year.	Quantity.	Value.
	Long tons.			*Long tons.*	
1882	12,000	$72,000	1892	109,788	$305,191
1883	25,000	137,500	1893	75,777	256,552
1884	35,000	175,000	1894	105,940	363,134
1885	49,000	220,500	1895	99,549	322,845
1886	55,000	220,000	1896	115,483	320,163
1887	52,000	210,000	1897	143,201	391,541
1888	54,331	167,658	1898	193,364	593,801
1889	93,705	202,119	1899	174,734	543,249
1890	99,854	273,745	1900	204,615	749,991
1891	106,536	338,880	1901	234,825	1,024,449

IMPORTS.

The following table shows the imports of pyrite containing not more than 3.5 per cent of copper from 1884 to 1901, inclusive:

Imports of pyrite containing not more than 3.5 per cent of copper from 1884 to 1901, inclusive. ([a])

Year.	Quantity.	Value.	Year.	Quantity.	Value.
	Long tons.			*Long tons.*	
1884	16,710	$50,632	1895	190,435	$673,812
1885	6,078	18,577	1896	200,168	648,396
1886	1,605	9,771	1897	259,546	747,419
1887	16,578	49,661	1898	252,773	717,813
1891	100,648	392,141	1899	269,868	1,077,061
1892	152,359	587,980	1900	322,484	1,055,121
1893	194,934	721,699	1901	403,706	1,415,149
1894	163,546	590,905			

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[a] Previous to 1884 classed among sulphur ores; from 1887 to 1891 classed among other iron ores; since 1891 includes iron pyrite containing 25 per cent or more of sulphur.

CONSUMPTION.

The imports of iron pyrite for use in the manufacture of sulphuric acid not having been stated separately by the Bureau of Statistics of the Treasury Department for years prior to 1891, a comparison with preceding years can not be made. The following table shows the quantity of pyrite mined and imported for the last five years, and as no exports are reported by the Treasury Department these figures may be accepted as representing the domestic consumption. The table also shows the estimated quantity of sulphur yearly displaced by pyrite on a basis of 45 per cent of sulphur content of the latter.

It will be observed that in the eleven years covered by the following table the quantity of sulphur displaced by pyrite for acid making has increased more than 200 per cent. In 1891 the amount of sulphur displaced by the use of pyrite was 93,233 long tons; in 1901 the amount of sulphur displaced was 287,339 long tons, more than three times that of 1891. This increased use of pyrite for acid making has been due very largely to the development of the sulphite wood-pulp industry for the manufacture of paper in which sulphur is used. There is but one sulphite mill in the United States using pyrite in place of sulphur in the treatment of the wood pulp, although in Europe a considerable quantity of pyrite is utilized for this purpose. Another important factor has been the increased production of phosphate rock from Florida and Tennessee and the domestic manufacture of superphosphates. For these purposes a chemically pure sulphuric acid is not essential, and that made from pyrite serves the purpose equally as well as that made from sulphur.

Quantity of pyrite consumed in the United States, and estimated amount of sulphur displaced by it from 1891 to 1901, inclusive.

Source.	1891.	1892.	1893.	1894.	1895.
	Long tons.	*Long tons.*	*Long tons.*	*Long tons.*	*Long tons.*
Domestic product	106,536	109,788	75,777	105,940	99,549
Imports	100,648	152,359	194,934	163,546	190,435
Domestic consumption	207,184	262,147	270,711	269,486	289,984
Sulphur displaced, estimated on basis of 45 per cent content	93,233	117,966	121,820	121,269	130,493

Source.	1896.	1897.	1898.	1899.	1900.	1901.
	Long tons.	*Long tons.*	*Long tons.*	*Long tons.*	*Long tons.*	*Long tons.*
Domestic product	115,483	143,201	193,364	174,734	204,615	234,825
Imports	200,168	259,546	252,773	269,868	322,484	403,706
Domestic consumption	315,651	402,747	446,137	444,602	527,099	638,531
Sulphur displaced, estimated on basis of 45 per cent content	142,043	181,236	200,762	200,071	237,195	287,339

CANADIAN PRODUCTION.

The production of iron pyrite in Canada decreased from 40,031 short tons in 1900 to 28,261 short tons in 1901, although the value per ton increased from $3.87 to $4. The production after 1894 showed a declining tendency until 1900, when it received the benefit of the increased demand in the United States. In 1901, however, the production was the smallest reported during the last sixteen years, except for the year 1899, when it equaled 27,687 short tons.

Since 1886 the production of pyrite in Canada has been as follows:

Annual production and value of pyrite in Canada from 1886 to 1901, inclusive.

Calendar year.	Quantity.	Value.	Calendar year.	Quantity.	Value.
	Short tons.			*Short tons.*	
1886	42,906	$193,077	1894	40,527	$121,581
1887	38,043	171,194	1895	34,198	102,594
1888	63,479	285,656	1896	33,715	101,155
1889	72,225	307,292	1897	38,910	116,730
1890	49,227	123,067	1898	32,218	128,872
1891	67,731	203,193	1899	27,687	110,748
1892	59,770	179,310	1900	40,031	155,164
1893	58,542	175,626	1901	28,261	113,004

WORLD'S PRODUCTION.

The following table has been compiled, chiefly from official sources, to show the pyrite production in the principal producing countries and to exhibit to what an extent pyrite has supplanted sulphur for acid making. In the case of Spain the exports are taken instead of the production for such years as they are available. The published figures of pyrite production in Spain show an output in each year averaging from 20 to 25 per cent of the exports. As the export figures are probably taken from the custom-house records, they are considered more reliable.

World's production of iron pyrite and quantity of sulphur displaced from 1892 to 1900, inclusive.

Country.	1892.	1893.	1894.	1895.	1896.
	Long tons.	*Long tons.*	*Long tons.*	*Long tons.*	*Long tons.*
Spain [a]	435,906	393,453	511,769	480,255	98,393
France	226,304	227,288	278,452	248,934	295,325
Portugal	....	2,046	....	192,174	204,105
United States	109,788	75,777	105,940	99,549	115,483
Germany	113,391	119,379	132,621	124,994	127,092
Norway	57,629	52,890	69,720	48,217	59,534
Hungary	27,575	67,093	75,635	68,083	51,851
Italy	27,225	28,987	22,274	37,966	44,993
Canada	53,372	52,270	36,185	30,534	30,103
Newfoundland	....	37,889	40,770	34,318	27,267
Russia	13,893	20,958	19,187	12,988	12,791
United Kingdom	13,967	15,837	15,523	9,048	10,017
Bosnia	....	....	....	197	1,968
Belgium	2,529	6,200	3,001	3,454	2,519
Sweden	1,229	472	645	217	993
Total	1,082,808	1,100,539	1,311,722	1,390,928	1,082,434
Sulphur displaced [b]	487,263	495,242	590,275	625,918	487,095

[a] Exports except in 1896.

[b] Based on estimated 45 per cent of sulphur content.

World's production of iron pyrite and amount of sulphur displaced from 1892 to 1900, inclusive—Continued.

Country.	1897.	1898.	1899.	1900.
	Long tons.	*Long tons.*	*Long tons.*	*Long tons.*
Spain[a]	217,545	255,896	316,212	350,296
France	298,571	306,002	313,087	309,170
Portugal	206,886	244,229	271,228	(b)
United States	143,201	193,364	174,734	204,615
Germany	131,160	134,650	142,299	166,724
Norway	92,966	88,320	94,099	(b)
Hungary	43,740	57,146	78,241	85,602
Italy	57,383	66,120	75,308	70,465
Canada	34,471	28,766	24,721	35,742
Newfoundland	32,790	32,335	26,154	(b)
Russia	19,069	24,175	22,877	(b)
United Kingdom	10,583	12,102	12,230	12,279
Bosnia	3,611	236	423	158
Belgium	1,798	145	278	394
Sweden	509	380	148	176
Total	1,294,283	1,443,866	1,552,039	[c] 1,640,979
Sulphur displaced[d]	582,427	649,739	698,418	738,440

[a] Exports except in 1896.
[b] Statistics not yet available.
[c] Latest available figures used in making up total.
[d] Based on estimated 45 per cent of sulphur content

GYPSUM.

By JOSEPH STRUTHERS.

PRODUCTION.

The total production of gypsum in the United States during 1901 was 659,659 short tons, valued at $1,577,493, as compared with the total production during 1900 of 594,462 short tons, valued at $1,627,203, which shows an increase of 65,197 short tons in quantity and a decrease of $49,710 in value.

There has been a remarkable increase in the production of gypsum in the United States during recent years. For the ten years previous to 1899 the annual output averaged 269,712 short tons. During 1900 the production rose to 594,462 short tons, and in 1901 to the maximum output of 659,659 short tons. The rapid development of the gypsum industry has resulted mainly from two causes: The increased use of plaster of paris in the manufacture of wall plaster in modern buildings, it having proved to be superior in hardness and durability to the lime plaster formerly used for this purpose, and the large quantities consumed in the manufacture of staff for the construction of temporary buildings, particularly those built for exposition purposes.

The total production of gypsum is classified under three heads: (1) Crude gypsum, which is sold as such; (2) gypsum ground into land plaster, and (3) gypsum calcined into plaster of paris.

The quantity of crude gypsum sold in 1901 was 72,669 short tons, valued at $76,773, as compared with 35,479 short tons, valued at $44,127, in 1900, which shows an increase of approximately 105 per cent over the production of 1900. The value per ton of the product, however, decreased from $1.24 in 1900 to $1.06 in 1901, the lowest price reported since 1890. Most of the gypsum sold in the crude state is used for land plaster, being ground for this purpose by consumers.

The quantity of gypsum ground into land plaster during 1901 was 65,698 tons, valued at $123,150, as compared with 45,682 tons, valued at $82,806, in 1900, which shows an increased production of 44 per cent over the figures for 1900. The value per ton was practically constant for the two years, averaging $1.81 in 1900 and $1.87 in 1901.

The quantity of gypsum calcined into plaster of paris in 1901 was 521,292 tons, valued at $1,377,570, as compared with 513,301 tons, valued at $1,500,270, in 1900. The value per ton decreased from $3.79 in 1900 to $3.34 in 1901. The value assigned to calcined plaster is for the quantity of plaster produced after calcination, and not for the raw material.

The production of gypsum in the United States during the last three years has been derived from 17 States and Territories, and although this mineral occurs in other States, the development of the properties has not yet been considered advantageous. A noteworthy feature of the gypsum industry during the year has been the consolidation of a number of independent producers into the United States Gypsum Company, as follows:

Companies consolidated into the United States Gypsum Company.

State.	Company.
Iowa	Baker Plaster Co.
Do	Carbon Plaster Co.
Do	Cardiff Gypsum Plaster Co.
Do	Duncombe Stucco Co.
Do	Fort Dodge Plaster Co.
Do	Iowa Plaster Association.
Do	Mineral City Plaster Co.
Kansas	Great Western Cement Plaster Co.
Do	Blue Valley Plaster Co.
Do	Blue Rapids Cement Plaster Co.
Do	Roman Cement Plaster Co.
Michigan	The Alabaster Co.
Do	Alabastine Co.
Do	Grand Rapids Gypsum Works.
Michigan	Grand Rapids Plaster Co.
Do	Gypsum Products Manufacturing Co.
Do	Michigan Plaster Co.
Do	Midland Plaster and Cement Co.
Do	New Buffalo Alabastine and Mineral Paint Manufacturing Co.
Do	John McPhee.
Do	Durr Plaster Co.
New York	English Plaster Works.
Do	Otto B. Englisch Plaster Co.
Do	Genesee Stucco Works.
Do	Big Four Plaster Co.
Oklahoma	Oklahoma Cement Plaster Co.

The following table has been compiled to show the progress of the gypsum industry during the last twelve years. The annual production and value of the three varieties of gypsum are given, together with the value per ton of each. This table shows particularly the remarkable increase in the amount of gypsum calcined into plaster of paris, which now approximates 80 per cent of the total output of gypsum. The value assigned to calcined plaster is for the quantity produced after calcination and not for the crude gypsum used:

Production of gypsum in the United States from 1890 to 1901, inclusive, classified as to variety.

Year.	Total amount produced.	Sold crude.			Ground into land plaster.		
		Quantity.	Value.	Average price per ton.	Quantity.	Value.	Average price per ton.
	Short tons.	*Short tons.*			*Short tons.*		
1890	182,995	18,742	$19,148	$1.02	56,525	$143,014	$2.53
1891	208,126	18,574	28,690	1.54	51,700	117,356	2.27
1892	256,259	58,080	80,797	1.39	47,668	106,247	2.23
1893	253,615	42,808	71,860	1.68	50,408	106,365	2.11
1894	239,312	34,702	56,149	1.62	41,996	95,944	2.28
1895	265,503	26,624	37,837	1.42	35,079	85,355	2.43
1896	224,254	17,302	19,134	1.11	27,354	59,749	2.18
1897	288,982	23,164	27,020	1.17	31,562	67,083	2.13
1898	291,638	5,758	7,200	1.25	40,929	90,777	2.22
1899	486,235	58,352	66,762	1.14	50,033	100,797	2.01
1900	594,462	35,479	44,127	1.24	45,682	82,806	1.81
1901	659,659	72,669	76,773	1.06	65,698	123,150	1.87

Year.	Calcined into plaster of paris.				Total value.
	Weight before calcining.	Calcined plaster produced.	Value.	Average price per ton.	
	Short tons.	*Short tons.*			
1890	107,728	79,257	$412,361	$5.20	$574,523
1891	137,852	110,006	482,005	4.38	628,051
1892	150,511	106,141	508,448	4.79	695,492
1893	160,399	122,937	518,390	4.22	696,615
1894	162,614	127,158	609,626	4.79	761,719
1895	203.800	150,801	674,255	4.47	797,447
1896	179,598	137,505	494,461	3.60	573,344
1897	234,256	180,935	661,761	3.66	755,864
1898	244,951	190,083	657,303	3.46	755,280
1899	377,850	286,227	1,119,521	3.91	1,287,080
1900	513,301	396,284	1,500,270	3.79	1,627,203
1901	521,292	412,908	1,377,570	3.34	1,577,493

PRODUCTION BY STATES.

The production by States during 1900 and 1901 is shown in the following tables. In order to protect individual statistics it has been necessary, in some instances, to combine the production of two or more States.

Production of gypsum in the United States in 1900, by States.

State.	Total product.	Sold crude.		Ground into land plaster.		Calcined into plaster of paris.			Total value.
		Quantity.	Value.	Quantity.	Value.	Before calcining.	After calcining.	Value.	
	Short tons.	*Short tons.*		*Short tons.*		*Short tons.*	*Short tons.*		
California	3,280	......	......	......	......	3,280	2,522	$10,088	$10,088
Colorado and Wyoming	5,812	125	$188	15	$60	5,672	4,487	29,281	29,529
Iowa, Kansas, and Texas	313,858	1,184	1,740	2,266	3,065	310,408	233,120	899,458	904,263
Michigan	129,654	32,328	40,410	10,354	13,930	86,972	70,489	230,779	285,119
New York	58,890	1,402	1,122	21,444	47,292	36,044	27,979	102,174	150,588
Oklahoma	18,437	......	......	......	......	18,437	14,881	60,380	60,380
Virginia	11,940	200	262	9,124	11,996	2,616	2,093	5,853	18,111
Other States [a]	52,591	240	405	2,479	6,463	49,872	40,713	162,257	169,125
Total	594,462	35,479	44,127	45,682	82,806	513,301	396,284	1,500,270	1,627,203

[a] Includes product of Arizona, 35 tons; Indian Territory, 6,500 tons; Montana, 1,025 tons; Nevada, 1,000 tons; Ohio, 39,034 tons; Oregon, 550 tons; South Dakota, 2,050 tons, and Utah, 2,397 tons.

Production of gypsum in the United States in 1901, by States.

State.	Total product.	Sold crude.		Ground into land plaster.		Calcined into plaster of paris.			Total value.
		Quantity.	Value.	Quantity.	Value.	Before calcining.	After calcining.	Value.	
	Short tons.	*Short tons.*		*Short tons.*		*Short tons.*	*Short tons.*		
California	3,550	3,550	$4,200	......	......	......	......	......	$4,200
Colorado and Wyoming	17,394	150	150	16	$62	17,228	13,595	$76,223	76,435
Iowa, Kansas, and Texas	213,419	2,750	3,575	3,079	5,025	207,590	164,720	620,736	629,336
Michigan	185,150	46,086	47,986	9,808	10,708	129,256	103,933	208,549	267,243
New York	119,565	11,678	10,908	33,591	61,093	74,296	55,273	169,668	241,669
Oklahoma	15,930	......	......	......	......	15,930	13,205	66,031	66,031
Virginia	15,236	1,054	1,104	9,675	25,995	4,507	3,752	18,045	45,144
Other States [a]	89,415	7,401	8,850	9,529	20,267	72,485	58,430	218,318	247,435
Total	659,659	72,669	76,773	65,698	123,150	521,292	412,908	1,377,570	1,577,493

[a] Includes the product of Arizona, 40 tons; Montana, 700 tons; Nevada, 2,000 tons; Ohio, 51,900 tons; Pennsylvania, 26,525 tons; South Dakota, 5,750 tons; Utah, 2,500 tons.

The total production and value by States from 1890 to 1901, inclusive, were as follows:

Production and value of gypsum by States from 1890 to 1901, inclusive.

State.	1890.		1891.		1892.		1893.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Short tons.		*Short tons.*		*Short tons.*		*Short tons.*	
Colorado	4,580	$22,050	....	....	....	....	....	....
Iowa	20,900	47,350	31,385	$58,095	([a])	([a])	21,447	$55,538
Kansas	20,250	72,457	40,217	161,322	46,016	$195,197	43,631	181,599
Michigan	74,877	192,099	79,700	223,725	139,557	306,527	124,590	303,921
New York	32,903	73,093	30,135	58,571	32,394	61,100	36,126	65,392
Ohio	([a])	([a])	([a])	([a])	([a])	([a])	([a])	([a])
South Dakota	2,900	7,750	3,615	9,618	....	....	5,150	12,550
Virginia	6,350	20,782	5,959	22,574	6,991	28,207	7,014	24,359
Other States	20,235	138,942	17,115	94,146	31,301	104,461	15,657	53,256
Total	182,995	574,523	208,126	628,051	256,259	695,492	253,615	696,615

State.	1894.		1895.		1896.		1897.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Short tons.		*Short tons.*		*Short tons.*		*Short tons.*	
California	....	....	5,158	$51,014	1,452	$11,738	([a])	([a])
Colorado	....	....	1,371	8,281	1,600	10,547	[b]12,309	$50,355
Iowa	17,906	$44,700	25,700	36,600	18,631	34,020	83,783	254,579
Kansas	64,889	301,884	72,947	272,531	49,435	148,371		
Michigan	79,958	189,620	66,519	174,007	67,634	146,424	94,874	193,576
New York	31,798	60,262	33,587	59,321	23,325	32,812	33,440	78,684
Ohio	20,827	69,597	21,662	71,204	([a])	([a])	([a])	([a])
South Dakota	4,295	16,050	6,400	20,600	([a])	([a])	8,350	19,240
Texas	6,925	27,300	10,750	36,511	([a])	([a])	24,454	65,651
Virginia	8,106	24,431	5,800	17,369	5,955	17,264	6,374	16,899
Other States	4,608	27,875	15,609	50,009	56,222	172,168	25,398	76,880
Total	239,312	761,719	265,503	797,447	224,254	573,344	288,982	755,864

State.	1898.		1899.		1900.		1901.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Short tons.		*Short tons.*		*Short tons.*		*Short tons.*	
California	3,800	$24,977	2,950	$14,950	3,280	$10,088	3,550	$4,200
Colorado	[c]5,390	23,712	[c]5,675	24,954	[c]5,812	29,529	[c]17,394	76,435
Iowa	83,913	237,208	75,574	296,220	[d]313,858	904,263	[d]213,419	629,336
Kansas			85,046	247,690				
Michigan	93,181	204,310	144,776	283,537	129,654	285,119	185,150	267,243
New York	31,655	81,969	52,149	105,533	58,890	150,588	119,565	241,669
Ohio	([a])	([a])	([a])	([a])	([a])	([a])	([a])	([a])
South Dakota	([a])	([a])	([a])	([a])	([a])	([a])	([a])	([a])
Texas	34,215	58,130	([a])	([a])	([e])	([e])	([e])	([e])
Virginia	8,378	23,388	11,480	32,043	11,940	18,111	15,236	45,144
Other States	31,106	101,586	108,585	282,153	71,028	229,505	105,345	[f]313,466
Total	291,638	755,280	486,235	1,287,080	594,462	1,627,203	659,659	1,577,493

[a] Included in other States.
[b] Includes Indian Territory.
[c] Includes Wyoming.
[d] Includes Texas.
[e] Included with Iowa and Kansas.
[f] Includes Oklahoma.

The following table shows the annual production of gypsum in the United States since 1880:

Production of gypsum in the United States from 1880 to 1901, inclusive.

Year.	Quantity.	Value.	Year.	Quantity.	Value.
	Short tons.			*Short tons.*	
1880	90,000	$400,000	1891	208,126	$628,051
1881	85,000	350,000	1892	256,259	695,492
1882	100,000	450,000	1893	253,615	696,615
1883	90,000	420,000	1894	239,312	761,719
1884	90,000	390,000	1895	265,503	797,447
1885	90,405	405,000	1896	224,254	573,344
1886	95,250	428,625	1897	288,982	755,864
1887	95,000	425,000	1898	291,638	755,280
1888	110,000	550,000	1899	486,235	1,287,080
1889	267,769	764,118	1900	594,462	1,627,203
1890	182,995	574,523	1901	659,659	1,577,493

IMPORTS.

The imports of gypsum are chiefly from Canada, the product from the Dominion being very pure and well adapted for the manufacture of plaster of paris. It will be noticed that the large increases in the production of domestic gypsum have not had any marked influence on the imports of Canadian gypsum. Most of this material is imported in the crude state and calcined into plaster of paris at various points in the New England States, New York, and New Jersey. The imports and value of crude or unground plaster in 1901 were the largest on record. What is also worthy of note is the decrease in the imports of calcined plaster, which in 1891 were valued at $97,316 and in 1901 were worth only $19,627. The following table exhibits the total quantity and value of gypsum imported into the United States since 1867:

Gypsum imported into the United States from 1867 to 1901, inclusive.

Year ending—	Ground or calcined.		Unground.		Value of manufactured plaster of paris.	Total value.
	Quantity.[a]	Value.	Quantity.	Value.		
June 30—	*Long tons.*		*Long tons.*			
1867		$29,895	97,951	$95,386		$125,281
1868		33,988	87,694	80,362		114,350
1869		52,238	137,039	133,430	$844	186,512
1870		46,872	107,237	100,416	1,432	148,720
1871		64,465	100,400	88,256	1,292	154,013
1872		66,418	95,339	99,902	2,553	168,873
1873		35,628	118,926	122,495	7,336	165,459
1874		36,410	123,717	130,172	4,319	170,901
1875		52,155	93,772	115,664	3,277	171,096
1876		47,588	139,713	127,084	4,398	179,070
1877		49,445	97,656	105,629	7,843	162,917
1878		33,496	89,239	100,102	6,989	140,587
1879		18,339	96,963	99,027	8,176	125,542
1880		17,074	120,327	120,642	12,693	150,409
1881		24,915	128,607	128,107	18,702	171,724
1882	5,737	53,478	128,382	127,067	20,377	200,922
1883	4,291	44,118	157,851	152,982	21,869	218,969
1884	4,996	42,904	166,310	168,000	([b])	210,904
1885	6,418	54,208	117,161	119,544		173,752
1886	5,911	37,642	122,270	115,696		153,338
1887	4,814	37,736	146,708	162,154		199,890
Dec. 31—						
1888	3,340	20,764	156,697	170,023		190,787
1889	5,466	40,291	170,965	179,849		220,140
1890	7,568	55,250	171,289	174,609		229,859
1891	9,560	97,316	110,257	129,003		226,319
1892	6,832	75,608	181,104	232,403		308,011
1893	3,363	31,670	164,300	180,254		211,924
1894	2,027	16,823	162,500	179,237		196,060
1895	3,295	21,526	192,549	215,705	10,352	247,583
1896	3,292	21,982	180,269	193,544	11,722	227,248
1897	2,664	17,028	163,201	178,686	16,715	212,429
1898	2,973	18,501	166,066	181,364	40,979	240,844
1899	3,265	19,250	196,579	220,603	58,073	297,926
1900	3,109	19,179	209,881	229,878	66,473	315,530
1901	3,106	19,627	235,204	238,440	68,603	326,670

[a] Quantity not reported previous to 1882.

[b] Not specified from 1884 to 1894, inclusive.

CANADIAN PRODUCTION AND EXPORTS.

As the imports of gypsum into the United States are principally from the provinces of Ontario, New Brunswick, and Nova Scotia, in the Dominion of Canada, the following table has been compiled to show the production in and the exports from the Dominion of Canada from 1886 to 1901, inclusive:

Production and exports of Canadian gypsum from 1886 to 1901, inclusive.

Year.	Production.		Exports.	
	Quantity.	Value.	Quantity.	Value.
	Short tons.		*Short tons.*	
1886	162,000	$178,742	107,237	$114,736
1887	154,008	157,277	148,533	166,514
1888	175,887	179,393	124,515	133,238
1889	213,273	205,108	176,875	189,491
1890	226,509	194,033	175,111	193,899
1891	203,605	206,251	172,496	184,977
1892	241,048	241,127	175,518	194,304
1893	192,568	196,150	[a] 176,489	178,979
1894	223,631	202,031	162,412	160,082
1895	226,178	202,608	[a] 160,898	156,897
1896	207,032	178,061	200,857	205,641
1897	239,691	244,531	180,540	183,376
1898	219,256	230,440	180,350	193,515
1899	244,566	257,329	163,719	166,222
1900	252,001	259,009	233,395	236,065
1901	293,799	340,148	172,010	185,208

[a] Entire exports were exported to the United States.

WORLD'S PRODUCTION.

The United States is the second country in the world as a producer of gypsum. France leads with more than one-half the entire world's production. Canada follows the United States in importance, though in one year (1896) the output of Great Britain exceeded that of Canada.

The following table shows, in short tons, the quantity of gypsum produced by the principal countries of the world in each year for which statistics are available since 1893:

The world's production of gypsum from 1893 to 1900, inclusive.

Year.	United States.		Great Britain.		Canada.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Short tons.		*Short tons.*		*Short tons.*	
1893	253,615	$696,615	158,122	$287,940	192,568	$196,150
1894	239,312	761,719	169,102	321,822	223,631	202,031
1895	265,503	797,447	196,037	348,400	226,178	202,608
1896	224,254	573,344	213,028	361,509	207,032	178,061
1897	288,982	755,864	203,151	325,513	239,691	244,531
1898	291,638	755,280	219,549	345,882	219,256	230,440
1899	486,235	1,287,080	238,071	372,073	244,566	257,329
1900	594,462	1,627,203	233,002	348,210	252,001	259,009

The world's production of gypsum from 1893 to 1900, inclusive—Continued.

Year.	France.		Algeria.		German Empire.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Short tons.		*Short tons.*		*Short tons.*	
1893	....	....	....	....	....	....
1894	1,693,831	$2,891,365	36,355	$114,900	....	....
1895	2,175,448	3,392,768	50,127	133,226	23,994	$11,040
1896	1,866,498	2,661,200	41,350	114,361	31,736	14,598
1897	1,845,874	2,673,033	40,510	109,648	28,821	13,228
1898	1,931,712	2,777,816	41,156	110,660	28,315	13,166
1899	1,802,812	2,641,020	44,037	117,895	32,760	19,660
1900	1,761,835	2,772,221	41,446	139,190	39,103	17,199

Year.	India.		Cyprus.	
	Quantity.	Value.	Quantity.	Value.
	Short tons.		*Short tons.*	
1893	....	....	2,357	$6,625
1894	3,548	$1,566	3,104	9,006
1895	7,511	2,987	2,093	5,252
1896	8,248	3,130	1,050	2,590
1897	9,025	3,333	4,167	8,162
1898	9,249	1,503	4,279	7,551
1899	7,216	768	6,170	12,981
1900	4,865	424	....	....

SALT.

By Joseph Struthers.

PRODUCTION.

Owing to the continued prosperity of trade and the resultant development of the industries based on the mineral output of the country, the production of salt in the United States during 1900 and 1901 was the largest for any two individual years yet recorded. The total production in 1901 was 20,566,661 barrels of 280 pounds each, showing a decrease of 302,681 barrels, or 1.5 per cent, from the production of 20,869,342 barrels in 1900. The value of the salt produced in 1901 was $6,617,449, a decrease of $327,154 from the value of $6,944,603 in 1900.

For convenience in discussing the details of the industry, salt is classified into "table and dairy," "common fine," "common coarse," "packers," "solar," "rock," "milling," and "other grades." The last-named division includes products not properly classible among the preceding. The chief product of "other grades" is brine salt, which is used in very large quantities for the manufacture of soda ash, sodium bicarbonate, sodium hydrate (caustic soda), and other sodium salts. During 1901 the United States manufactured 529,104 short tons of sodium salts of all varieties, and the quantity of salt, chiefly in the form of brine, required to make this product was in excess of 1,000,000 short tons, equivalent to more than 4,000,000 barrels.

The tables on the following pages show the progress that has been made in the salt industry since 1880, and the enormous increase in production from 5,961,060 barrels in 1880 to 20,566,661 barrels in 1901, which is an increase of over 240 per cent. During the last eighteen years the yearly production has regularly increased, with the exception of 1889, when the output was 50,000 barrels, or 0.6 per cent less than that of 1888, and in 1901, when the output was practically 300,000 barrels, or 1.5 per cent less than in 1900. Notwithstanding, and perhaps because of, the rapid increase in the production of salt in the United States during the last twenty years, the business has not been a lucrative one. This condition was due in a great many cases to overproduction and keen competition for trade, and as a natural result the tendency to combination which has been marked in other industries during the last few years extended also to the salt manufacturers. Combinations have been effected among the majority of producers in New York, Ohio, Michigan, Kansas, Utah, and California, which are among the most important of the salt-producing States.

The following table presents the distribution of the total salt production of the United States, by grades, during the last eight years, from which it will be observed that the production of common fine salt has approximated 40 per cent of the total output during this period.

Production of salt by grades in the United States, from 1893 to 1901, inclusive.

Year.	Table and dairy.	Common fine.	Common coarse.	Packers'.	Solar.
	Barrels.	*Barrels.*	*Barrels.*	*Barrels.*	*Barrels.*
1893	1,791,577	5,478,054	444,498	96,657	2,110,287
1894	2,839,140	5,281,754	438,074	103,041	587,305
1895	2,173,123	6,099,480	280,284	118,801	983,870
1896	2,230,409	6,598,733	300,365	163,035	2,531,086
1897	2,555,278	6,868,798	516,143	609,378	3,614,491
1898	2,198,339	8,583,128	873,671	379,635	3,077,024
1899	1,866,165	6,883,352	4,562,217	182,930	3,483,858
1900	2,312,130	6,773,217	1,921,321	145,305	1,086,916
1901	2,177,447	7,159,953	1,630,560	84,636	1,200,141

Year.	Rock.	Milling.	Other grades.	Total product.	Total value.
	Barrels.	*Barrels.*	*Barrels.*	*Barrels.*	
1893	1,884,145	5,141	6,413	11,816,772	$4,154,668
1894	2,266,606	95,621	1,356,876	12,968,417	4,739,285
1895	2,089,763	40,107	1,884,221	13,669,649	4,423,684
1896	1,783,886	133,271	109,941	13,850,726	4,040,839
1897	1,649,459	....	159,655	15,973,202	4,920,020
1898	2,183,801	156,579	160,457	17,612,634	6,212,554
1899	2,544,036	96,178	89,878	19,708,614	6,867,467
1900	2,974,033	85,357	5,571,063	20,869,342	6,944,603
1901	3,237,938	72,460	5,003,526	20,566,661	6,617,449

The total yearly production of salt in the United States since 1880 is given in the following table, which shows that in proportion to the production, the value in some of the earlier years was greater than it has been since 1892. This is due in part to the fact that the competition was not so strong during the first ten years of which records have been available, and in part to the fact that the value of the product when reported by a great many of the manufacturers included the value of the packages in which the salt was shipped. Since 1893 the value as stated includes only the net value of the product, exclusive of any boxes, bags, barrels, or other packages:

Production and value of salt in the United States from 1880 to 1901, inclusive.

Year.	Quantity.	Value.	Year.	Quantity.	Value.
	Barrels.			*Barrels.*	
1880	5,961,060	$4,828,566	1891	9,987,945	$4,716,121
1881	6,200,000	4,200,000	1892	11,698,890	5,654,915
1882	6,412,373	4,320,140	1893	11,897,208	4,154,668
1883	6,192,231	4,251,042	1894	12,968,417	4,739,285
1884	6,514,937	4,197,734	1895	13,669,649	4,423,084
1885	7,038,653	4,825,345	1896	13,850,726	4,040,839
1886	7,707,081	4,825,345	1897	15,973,202	4,920,020
1887	8,003,962	4,093,846	1898	17,612,634	6,212,554
1888	8,055,881	4,374,203	1899	19,708,614	6,867,467
1889	8,005,565	4,195,412	1900	20,869,342	6,944,603
1890	8,876,991	4,752,286	1901	20,566,661	6,617,449

PRODUCTION BY STATES.

Previous to 1893, Michigan was the chief salt-producing State; in that year New York assumed the lead and maintained the foremost position until 1901, when Michigan again resumed the supremacy with a production of 7,729,641 barrels as compared with a production of 7,286,320 barrels in New York. The production of salt in Michigan during 1901 was increased by 519,020 barrels over that of the preceding year, while the output from New York was diminished by 610,751 barrels.

The production and the percentage of the total product of the four leading salt-producing States during 1901 is as follows: Michigan, 7,729,641 barrels (37.6 per cent); New York, 7,286,320 barrels (35.4 per cent); Kansas, 2,087,791 barrels (10.2 per cent), and Ohio, 1,153,535 barrels (5.6 per cent). These four States contributed 88.8 per cent of the total quantity of salt produced in the United States during the year.

Production of salt, by States and Territories, during 1898, 1899, 1900, and 1901.

State or Territory.	1898.		1899.		1900.		1901.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Barrels.		*Barrels.*		*Barrels.*		*Barrels.*	
New York	6,791,798	$2,369,323	7,489,105	$2,540,426	7,897,071	$2,171,418	7,286,320	$2,089,834
Michigan	5,263,564	1,628,081	7,117,382	2,205,924	7,210,621	2,033,731	7,729,641	2,437,677
Kansas	1,882,329	616,591	1,645,350	546,291	2,233,878	1,076,945	2,087,791	614,365
Ohio	1,682,247	826,868	1,460,516	575,864	1,425,283	696,326	1,153,535	455,924
Oklahoma	....	....	....	....	5,861	6,136	7,506	5,986
California	653,009	185,848	642,563	281,741	621,857	216,291	601,659	133,656
Texas	(a)	(a)	312,436	204,330	(a)	(a)	(a)	(a)
West Virginia	247,668	88,462	221,534	107,987	243,873	118,407	231,722	94,732
Utah	266,250	103,778	236,135	115,100	249,128	151,662	334,484	326,016
Pennsylvania	154,287	46,000	(a)	(a)	(a)	(a)	(a)	(a)
Other States	671,482	347,603	583,593	289,804	981,770	473,687	1,134,003	459,259
Total	17,612,634	6,212,554	19,708,614	6,867,467	20,869,342	6,944,603	20,566,661	6,617,449

[a] Included in other States.

DOMESTIC CONSUMPTION.

The following table has been compiled to show the increase in the proportion of salt produced in the United States which has entered into the domestic consumption. Of the total consumption of salt in the United States the quantity of salt of domestic production used increased from 63.5 per cent in 1880 to 93.45 per cent in 1901, while the consumption of salt imported into the United States decreased from 36.5 per cent of the total in 1880 to 6.55 per cent in 1901. The actual consumption in 1901 was 21,940,235 barrels, or more than 2.3 times that of 1880. In 1880 the production in the United States was 5,961,060 barrels and the imports 3,427,639 barrels. The corresponding figures for 1901 show a remarkable increase, to 20,566,661 barrels of domestic salt produced, while the imports decreased to 1,440,950 barrels.

The following table presents the production, imports, exports, and domestic consumption since 1880:

Supply of salt for domestic consumption from 1880 to 1901, inclusive.

[Barrels.]

Source.	1880.	1881.	1882.	1883.
Domestic production	5,961,060	[a] 6,000,000	6,412,373	6,192,231
Imports	3,427,639	3,839,994	3,085,168	3,099,698
Total	9,388,699	9,839,994	9,497,541	9,291,929
Exports	4,436	9,091	8,417	10,829
Domestic consumption	9,384,263	9,830,903	9,489,124	9,281,100
Increase over preceding year	....	446,640	[b] 341,779	[b] 208,024
Percentage of imports to total consumption	36.5	39.1	32.5	33.4

Source.	1884.	1885.	1886.	1887.
Domestic production	6,514,937	7,038,653	7,707,081	8,003,962
Imports	3,246,349	3,227,380	2,818,623	2,587,745
Total	9,761,286	10,266,033	10,525,704	10,591,707
Exports	14,003	14,649	17,246	16,732
Domestic consumption	9,747,283	10,251,384	10,508,458	10,574,975
Increase over preceding year	466,183	504,101	257,074	66,517
Percentage of imports to total consumption	33.3	31.5	26.8	24.5

Source.	1888.	1889.	1890.	1891.
Domestic production	8,055,881	8,055,565	8,876,991	9,987,945
Imports	2,232,253	1,833,452	1,838,024	1,694,048
Total	10,288,134	9,889,017	10,715,015	11,681,993
Exports	19,140	19,209	17,597	15,889
Domestic consumption	10,268,994	9,869,808	10,697,418	11,666,104
Increase over preceding year	[b] 305,981	[b] 399,186	827,610	968,686
Percentage of imports to total consumption	21.7	18.5	17.2	14.5

[a] Estimated.

[b] Decrease.

Supply of salt for domestic consumption from 1880 to 1901, inclusive—Continued.

[Barrels.]

Source.	1892.	1893.	1894.	1895.
Domestic production	11,698,890	11,897,208	12,968,417	13,669,649
Imports	1,633,419	1,244,711	1,550,555	1,996,970
Total	13,332,309	13,141,919	14,518,972	15,666,619
Exports	18,603	20,686	38,763	36,855
Domestic consumption	13,313,706	13,121,233	14,480,209	15,629,764
Increase over preceding year	1,647,602	[a] 192,473	1,358,976	1,149,555
Percentage of imports to total consumption	12.3	9.49	10.71	12.78

Source.	1896.	1897.	1898.	1899.	1900.	1901.
Domestic production	13,850,726	15,973,202	17,612,634	19,708,614	20,869,342	20,566,661
Imports	1,858,614	1,493,033	1,325.212	1,350,366	1,427,921	1,440,950
Total	15,709,340	17,466,235	18,937,846	21,058,980	22,297,263	22,007,611
Exports	63,394	54,195	61,715	90,000	53,650	67,376
Domestic consumption	15,645,949	17,412,040	18.876,131	20,968,980	22,243,613	21,940,235
Increase over preceding year	16.185	1,766.091	1,464,091	2,092,849	1.274,633	[a] 303,378
Percentage of imports to total consumption	11.88	8.57	7.02	6.4	6.4	6.6

[a] Decrease.

IMPORTS AND EXPORTS.

The imports of salt into the United States from 1867 to 1881, as reported by the Bureau of Statistics of the Treasury Department, show an increase from 483,775,185 pounds in the former year to 1,075,198,397 pounds in 1881, the largest quantity yet recorded. From 1881 the imports decreased almost as steadily until 1893, when 348,519,173 pounds were reported, the smallest yearly quantity recorded since 1867. The decrease was largely in the imports of fine salt, due to the domestic production of table, dairy, and other special grades of salt equal, if not superior, in quality and price to the imported article. The tariff act of 1894 placed salt upon the free list, and importations increased to 434,155,708 pounds in 1894, and to nearly 560,000,000 pounds in 1895. In 1896 the imports of foreign salt amounted to 520,411,822 pounds. The tariff act of 1897 returned salt to the dutiable list. Salt in bags, barrels, or other packages is now subjected to a duty of 12 cents per 100 pounds (33.6 cents per barrel), and salt in bulk is taxed at the rate of 8 cents per 100 pounds, or 22.4 cents per barrel. The duty on imported salt in bond used in curing fish taken by vessels licensed to engage in the fisheries and in curing fish on the navigable waters of the United States, or on salt used in curing meats for export, may be remitted. The quantity of salt imported in 1897 was nearly 20 per cent less than in 1896, the total amounting to 418,049,214 pounds, and in 1898 the imports fell off to 371,059,452 pounds, with one exception the smallest amount reported in thirty-two years. In 1899 the imports increased to 378,102,567 pounds, but the value showed a decline of about $9,000 from that of 1898. In 1900 the imports increased to 399,817,824 pounds, and in 1901 there was a still further slight increase to 403,465,946 pounds.

Since 1867 the imports have been as follows:

Salt imported and entered for consumption in the United States, 1867 to 1901, inclusive.

Year ending—	In bags, barrels, and other packages.		In bulk.	
	Quantity.	Value.	Quantity.	Value.
June 30—	*Pounds.*		*Pounds.*	
1867	254,470,862	$696,570	229,304,323	$336,302
1868	308,446,080	915,546	219,975,096	365,458
1869	297,382,750	895,272	256,765,240	351,168
1870	288,479,187	797,194	349,776,433	507,874
1871	283,993,799	800,454	274,730,573	355,318
1872	258,232,807	788,893	257,637,230	312,569
1873	239,494,117	1,254,818	388,012,132	525,585
1874	358,375,496	1,452,161	427,294,209	649,838
1875	318,673,091	1,200,541	401,270,315	549,111
1876	331,266,140	1,153,480	379,478,218	462,106
1877	359,005,742	1,059,941	444,044,370	532,831
1878	352,109,963	1,062,995	414,813,516	483,909
1879	375,286,472	1,150,018	434,760,132	532,706
1880	400,970,531	1,180,082	449,743,872	548,425
1881	412,442,291	1,242,543	529,361,041	658,068
1882	329,969,300	1,086,932	399,100,228	474,200
1883	312,911,360	1,035,946	412,938,686	451,001
1884	340,759,010	1,093,628	441,613,517	433,827
1885	351,276,969	1,030,029	412,322,341	386,858
Dec. 31—				
1886	319,232,750	966,993	366,621,223	371,000
1887	275,774,571	850,069	343,216,331	328,201
1888	238,921,421	620,425	272,650,231	246,022
1889	180,906,293	627,134	234,499,635	249,232
1890	172,611,041	575,260	243,756,044	252,848
1891	150,033,182	492,144	220,309,985	224,569
1892	150,799,014	488,108	201,366,103	196,371
1893	98,037,648	358,575	146,945,390	63,404
1894	60,793,685	206,229	101,525,281	86,718
1895	601,086	1,723	1,874,644	1,874
1896	350,620	814	1,627,030	1,640
1897	36,801,048	114,072	50,775,105	46,412
1898	114,573,146	361,366	178,458,117	165,784
1899	119,720,721	372,921	158,263,237	133,862
1900	113,194,092	368,802	198,697,810	193,873
1901	117,140,960	413,899	171,067,229	165,805

Salt imported and entered for consumption in the United States, etc.—Continued.

Year ending—	For the purpose of curing fish.		Not elsewhere specified.		Total quantity.	Total value.
	Quantity.	Value.	Quantity.	Value.		
June 30—	*Pounds.*		*Pounds.*		*Pounds.*	
1867	....	....	....	....	483,775,185	$1,032,872
1868	....	....	....	....	528,421,176	1,281,004
1869	....	....	....	....	554,147,990	1,246,440
1870	68,597,023	$87,048	....	....	706,852,643	1,392,116
1871	64,671,139	66,008	....	....	623,395,511	1,221,780
1872	57,830,929	60,155	....	....	773,700,966	1,161,617
1873	86,756,628	86,193	....	....	714,262,877	1,866,596
1874	105,613,913	126,896	....	....	891,283,618	2,228,895
1875	110,294,440	119,607	....	....	830,237,846	1,869,259
1876	118,760,638	126,276	....	....	829,504,996	1,741,862
1877	132,433,972	140,787	....	....	935,484,084	1,733,559
1878	100,794,611	96,898	....	....	867,718,090	1,643,802
1879	94,060,114	95,841	....	....	904,106,718	1,778,565
1880	109,024,446	119,667	....	....	959,738,849	1,848,174
1881	133,395,065	144,347	....	....	1,075,198,397	2,044,958
1882	134,777,569	147,058	....	....	863,847,097	1,708,190
1883	142,065,557	154,671	....	....	867,915,603	1,641,618
1884	126,605,276	122,463	....	....	908,977,803	1,649,918
1885	140,067,018	121,429	....	....	903,666,328	1,538,316
Dec. 31—						
1886	103,360,362	94,721	....	....	789,214,335	1,432,714
1887	105,577,947	107,089	....	....	724,568,849	1,285,359
1888	113,459,083	111,120	....	....	625,030,735	977,577
1889	97,960,624	100,123	....	....	513,366,552	976,489
1890	98,279,719	96,648	....	....	514,646,804	924,753
1891	103,990,324	89,196	....	....	474,333,491	805,909
1892	105,192,086	90,327	....	....	457,357,203	774,806
1893	103,536,135	87,749	....	....	348,519,173	509,728
1894	93,723,885	79,482	178,112,857	$263,707	434,155,708	636,136
1895	8,668,490	12,195	548,007,449	739,122	559,151,669	754,914
1896	8,351,913	11,814	510,082,259	687,890	520,411,822	702,158
1897	32,961,953	33,962	297,511,108	370,592	418,049,214	565,038
1898	78,028,189	61,503	....	....	371,059,452	588,653
1899	100,118,609	72,899	....	....	378,102,567	579,682
1900	87,925,922	71,632	....	....	399,817,821	634,307
1901	115,257,757	96,628	....	....	403,465,946	676,332

Salt of domestic production exported from the United States from 1790 to 1901, inclusive.

Year ending—	Quantity.	Value.	Year ending—	Quantity.	Value.
Sept. 30—	*Bushels.*		June 30—	*Bushels.*	
1790	31,935	$8,236	1865	589,537	$358,109
1791	4,208	1,052	1866	70,644	300,980
1830	47,488	22,978	1867	605,825	304,030
1831	45,847	26,848	1868	624,970	289,936
1832	45,072	27,914	1869	442,947	190,076
1833	25 069	18,211	1870	298,142	119,582
1834	89,064	54,007	1871	120,156	47,115
1835	126,230	46,483	1872	42,603	19,978
1836	49,917	31,943	1873	73,323	43,777
1837	99,133	58,472	1874	31,657	15,701
1838	114,155	67,707	1875	47,094	16,273
1839	264,337	64,272	1876	51,014	18,378
1840	92,145	42,246	1877	65,771	20,133
1841	215,084	62,765	1878	72,427	24,968
1842	110,400	39,064	1879	43,710	13,612
June 30—			1880	22,179	6,613
1843[a]	40,678	10,262	1881	45,455	14,752
1844	157,529	47,755	1882	42,085	18,265
1845	131,500	45,151	1883	54,147	17,321
1846	117,627	30,520	1884	70,014	26,007
1847	202,244	42,333	1885	[b]4,101,587	26,488
1848	219,145	73,274	Dec. 31—		
1849	312,063	82,972	1886	4,828,863	29,580
1850	319,175	75,103	1887	4,685,080	27,177
1851	344,061	61,424	1888	5,359,237	32,986
1852	1,467,676	89,316	1889	5,378,450	31,405
1853	515,857	119,729	1890	4,927,022	30,079
1854	548,185	159,026	1891	4,448,846	23,771
1855	536,073	156,879	1892	5,208,935	28,399
1856	698,458	311,495	1893	5,792,207	38,375
1857	576,151	190,699	1894	10,853,759	46,780
1858	533,100	162,650	1895	7,203,024	30,939
1859	717,257	212,710	1896	10,711,314	43,202
1860	475,445	129,717	1897	11,593,321	52,320
1861	537,401	144,046	1898	17,280,193	63,624
1862	397,506	228,109	1899	25,200,191	86,465
1863	584,901	277,838	1900	15,021,861	65,410
1864	635,519	296,088	1901	18,865,247	86,414

[a] Nine months.

[b] Pounds from 1885.

In connection with the foregoing tables it is interesting to note the sources from which the imported salt is obtained and the markets supplied by the exports of domestic salt. For this purpose the following tables, showing the countries from which we import, the quantity and value of the salt received from each, and also the quantity and value of the salt exported, by countries, are given for the three fiscal years ending June 30, 1899, 1900, and 1901. It will be observed that Great Britain is the principal exporter of salt to the United States, the quantity imported from the United Kingdom averaging somewhat over 40 per cent of the total imports. Next in importance are the

West Indian islands (chiefly British), followed by Italy. The amount received from all other countries is comparatively small.

The principal exports are through the port of San Francisco, to the Central American States, Mexico, the Hawaiian Islands, Japan, and Asiatic Russia. About 25 per cent, or a little more, is shipped across the Great Lakes to the Dominion of Canada.

The imports and exports for the last three fiscal years, with the countries from which imported and to which exported, are given in the following tables:

Imports of salt during the fiscal years ending June 30, 1899, 1900, and 1901.

Country from which imported.	Year ending June 30, 1899.		Year ending June 30, 1900.		Year ending June 30, 1901.	
	Dutiable and free.		Dutiable and free.		Dutiable and free.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Pounds.		*Pounds.*		*Pounds.*	
United Kingdom	155,802,586	$401,397	174,211,930	$449,520	165,659,476	$447,012
Italy	68,133,438	42,562	89,445,529	43,851	86,370,630	46,391
Canada	3,850,891	7,719	8,359,966	14,971	5,865,395	13,821
West Indies	131,962,790	102,825	133,734,505	111,939	135,477,860	118,118
Other countries	4,033,228	4,419	5,040,510	5,582	14,551,271	11,425
Total	363,782,933	558,922	410,792,440	625,863	407,924,632	636,767

Exports of salt during the fiscal years ending June 30, 1899, 1900, and 1901.

Country to which exported.	Year ending June 30, 1899.		Year ending June 30, 1900.		Year ending June 30, 1901.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Pounds.		*Pounds.*		*Pounds.*	
United Kingdom	45,230	$360	3,000	$49	11,950	$213
Bermuda	155,088	1,589	135,140	1,346	155,825	1,619
British Honduras	19,951	223	19,152	304	10,260	151
Dominion of Canada:						
Nova Scotia, New Brunswick, etc	30,383	572	51,630	679	31,115	705
Quebec, Ontario, etc	2,415,988	6,832	2,888,751	10,409	2,413,357	6,301
British Columbia	2,012,080	7,755	2,197,726	7,042	2,509,484	10,513
Newfoundland and Labrador	107,320	1,028	95,865	973	104,011	946
Central American States:						
Costa Rica	140,945	1,058	106,380	1,309	141,188	1,321
Guatemala	693,797	4,714	15,995	167	371,634	1,903
Honduras	99,242	1,004	131,487	1,506	165,408	1,354
Nicaragua	270,931	3,216	285,400	2,947	332,063	2,942
Salvador	37,500	146	4,500	17	....	....
Mexico	1,713,796	10,872	1,090,033	9,243	1,177,080	10,273
West Indies:						
British	129,415	$512	226,900	$1,177	188,341	$1,382
Danish	500	3	2,300	25	1,300	16
French	10,180	120	11,211	133	11,613	155
Haiti	4,793	60	2,400	37	4,897	68
Porto Rico	2,426	19	13,602	105	....	....

Exports of salt during the fiscal years ending June 30, 1899, 1900, and 1901—Continued.

Country to which exported.	Year ending June 30, 1899.		Year ending June 30, 1900.		Year ending June 30, 1901.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
West Indies—Continued.	*Pounds.*		*Pounds.*		*Pounds.*	
Santo Domingo	27,744	$322	30,292	$335	38,226	$485
Cuba	853,572	5,311	399,431	2,227	357,095	1,868
Colombia	112,057	699	121,371	1,043	173,875	2,013
Japan	1,204,000	2,810	1,111,400	2,485	1,485,430	5,061
China	114,200	245	....	....	40	1
Russia, Asiatic	14,093,100	32,020	2,502,000	6,220	3,535,300	12,236
French Oceania	103,950	500	114,850	475	158,075	700
British Australasia	169,100	859	162,400	748	459,916	3,690
Hawaiian Islands	634,970	2,843	851,500	3,689	....	....
Philippine Islands	....	....	74,800	416	....	....
British Africa	14,000	145	7,300	71	8,785	88
Other countries	40,376	478	75,103	656	336,899	1,312
Total	25,256,634	86,315	12,731,919	55,833	14,183,167	67,316

WORLD'S PRODUCTION.

With the exception of the production of the United States and Canada, the latest statistics available for the countries contributing to the world's supply of salt are for the calendar year 1900. The subsequent table, accordingly, brings the output for these countries down to that year only. It shows that the United States, which since 1892 has held second place among the countries of the world, became the leader in 1897, ranking Great Britain by about 5 per cent. This advantage was increased in 1898 by a gain in the production of the United States and a decrease in the output of Great Britain, and was further augmented in 1899 by an increase in production nearly eight times as large as that of Great Britain for that year. In 1900 the United States reported an increase in production of approximately 160,000 short tons, whereas the output of Great Britain was 60,000 short tons less than in 1899. It is thus shown that the United States has not only maintained but has materially increased the lead over her principal rival in recent years. The total production of salt in the United States during 1900 was 40 per cent greater than that of Great Britain for that year.

In 1899 the production of salt in Great Britain increased over that of the preceding year for the first time since 1894, though it fell off again in 1900, whereas the production of salt in the United States has increased annually from 1890 to 1900. The table further shows that the United States produced in 1900 a little over 23 per cent of the world's supply, and that Great Britain produced but 16.6 per cent. The latest statistics available for Russia are for the calendar year 1899, when the production was 14.8 per cent of the total; Germany's production in 1900 was about 14 per cent of the total; France produced not quite 9.6 per cent, and India 9 per cent; Austria-Hungary produced a little less than 4.6 per cent in 1900. It is noticeable, however, that while the production of Austria-Hungary was less than 5 per cent of the total world's output, the value of the product in that country was nearly 47 per cent of the total value of the world's production. This is due to the fact that the salt-producing industry of Austria-Hungary is a government monopoly and one of its principal sources of revenue. The production of salt in Austria-Hungary in 1900 was less than one-fifth the production in the United States, though the value of the salt product of the United States was but little more than one-third of that produced in Austria-Hungary. The value of the product in Austria-Hungary was more than six times that of Great Britain, the value of whose product was considerably less than one-half that of the United States, though the amount produced in the United States was 40 per cent more than that of Great Britain. The first cost of salt to the consumer in the United States is a little over $2 per ton; in Austria-Hungary it is nearly $34 per ton, and with such conditions the small production is readily accounted for. The mere fact that salt is so cheaply produced in Great Britain and in the United States has increased its consumption, and has had no little influence in the development of the packing industries, the manufacture of hydrochloric acid, chlorine, and sodium salts, and also in the development of the chlorination process for the extraction of gold from its ores, and of the wet processes for the treatment of silver ores.

In the following table the statistics of salt production in the principal countries of the world are shown for each year from 1890 to 1900, with the exception of Russia, where the latest statistics available are for 1899. The production of salt in Turkey is not included. The industry in that country, as in Austria-Hungary, is a government monopoly, and no statistics of production are published. For the sake of convenience the quantities are expressed in short tons.

The world's salt production from 1890 to 1900, inclusive.

Year.	United States.		Great Britain.		France.[a]		German Empire.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Short tons.		*Short tons.*		*Short tons.*		*Short tons.*	
1890	1,242,778	$4,752,286	2,403,462	$5,354,400	955,434	$3,458,174	1,156,769	$3,750,642
1891	1,398,312	4,040,839	2,288,800	4,737,596	932,292	2,868,945	1,289,560	3,903,438
1892	1,637,845	5,654,915	2,191,307	4,177,795	1,100,898	3,318,366	1,286,365	3,968,650
1893	1,665,609	4,154,668	2,154,912	3,565,827	1,248,560	3,291,422	1,293,748	4,016,909
1894	1,815,438	4,739,285	2,504,221	3,703,601	1,001,498	2,762,216	1,386,316	4,143,710
1895	1,913,751	4,423,084	2,434,043	3,442,292	988,273	2,421,378	1,347,014	4,131,945
1896	1,939,102	4,040,839	2,265,040	3,233,073	1,178,038	2,492,402	1,436,258	4,204,910
1897	2,236,248	4,920,020	2,131,912	3,017,564	1,070,290	2,236,755	1,306,684	3,730,950
1898	2,465,769	6,212,554	2,103,718	3,016,011	1,132,415	2,156,196	1,510,511	3,755,201
1899	2,759,206	6,867,467	2,144,680	3,134,873	1,334,962	2,484,103	1,578,314	3,783,270
1900	2,921,708	6,944,603	2,084,709	3,059,600	1,199,675	2,415,973	1,749,385	3,567,000

Year.	Japan.		Italy.		Austria-Hungary.[b]	
	Quantity.	Value.[c]	Quantity.	Value.	Quantity.	Value.
	Short tons.		*Short tons.*		*Short tons.*	
1890	544,030	....	524,552	$999,933	515,736	$17,863,887
1891	616,795	....	492,144	927,812	508,022	17,436,392
1892	633,449	....	461,738	857,692	490,390	16,069,952
1893	744,717	....	466,146	990,283	524,552	16,475,059
1894	708,500	....	477,166	912,118	565,326	17,256,516
1895	671,416	....	526,370	1,030,350	530,062	17,075,675
1896	586,323	....	497,915	935,466	538,951	15,497,873
1897	691,947	....	507,778	968,031	554,078	15,725,518
1898	712,878	....	497,002	802,108	639,830	19,535,222
1899	650,834	....	432,720	616,144	578,000	18,112,471
1900	....	....	404,715	602,440	572,642	19,267,216

Year.	Russia.		Spain.		India.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Short tons.		*Short tons.*		*Short tons.*	
1890	1,531,736	$2,613,611	678,531	$1,750,444	1,159,395	$1,948,104
1891	1,489,008	4,978,589	642,292	1,687,300	1,139,468	1,690,294
1892	1,608,595	4,627,700	750,059	2,505,855	1,008,330	1,750,317
1893	1,489,687	4,281,970	166,913	82,076	940,547	1,546,597
1894	1,493,572	3,317,160	227,645	85,786	1,452,654	2,538,121
1895	1,705,896	3,887,090	359,604	918,775	1,282,522	2,058,678
1896	1,484,782	4,917,250	574,970	1,113,494	1,131,472	1,753,371
1897	1,682,337	4,357,253	560,484	1,118,720	1,033,601	1,560,415
1898	1,642,980	4,255,318	527,858	989,704	1,104,513	1,902,377
1899	1,852,861	2,767,168	659,140	1,052,988	1,031,149	1,637,836
1900	(*d*)	(*d*)	495,965	834,535	1,125,611	1,146,363

[a] Includes product of Algeria.

[b] Government monopoly.

[c] No value obtainable.

[d] Production in 1899 is used in making up the total for the world's production.

The world's salt production from 1890 to 1900, inclusive—Continued

Year.	Canada.		Other countries.		Total.	
	Quantity.	Value.	Quantity.	Value.	Quantity.[a]	Value.
	Short tons.		*Short tons.*		*Short tons.*	
1890	43,754	$198,857	....	....	10,212,147	$42,690,338
1891	45,021	161,179	....	....	10,224,919	42,432,384
1892	45,486	162,041	....	....	10,581,013	43,093,283
1893	62,324	195,926	....	....	10,013,004	38,600.737
1894	57,199	170,687	[b] 2,772	$9,515	10,983,807	39,638,715
1895	52,376	160,455	[c] 159,129	1,155,738	11,299,040	40,605,460
1896	43,960	169,693	[d] 128,959	408,111	11,219,447	38,766,482
1897	51,348	225,730	[d] 35,373	204,468	11,170,133	38,065,424
1898	57,126	248,639	[e] 463,707	1,567,034	12,145,429	41,410,364
1899	57,095	234,520	123,179	755,531	12,551,306	41,446,371
1900	62,055	279,458	81,717	511,737	12,551,043	41,396,093

[a] Not including production of Japan, for which no value is obtainable.

[b] Cape Colony and Ceylon.

[c] Cape Colony, Ceylon, Greece, Bosnia, and Herzegovina.

[d] Cape Colony, Greece, Bosnia, and Herzegovina.

[e] In addition to this amount Brazil produced 26,882; Peru, 19,836; Roumania, 119,103; Switzerland, 52,116; Turkey, 247,663. Total, 465,600 short tons, for which no value is given.

BROMINE.

By Joseph Struthers.

PRODUCTION.

The production of bromine in the United States during 1901, including the proportionate quantity of bromine contained in potassium bromide, amounted to 552,043 pounds, valued at $154,572, as compared with 521,444 pounds in 1900, valued at $140,790, an increase of 30,599 pounds for the year. The price per pound during 1901 averaged 28 cents, as compared with 27 cents in 1900 and 29 cents in 1899.

The production of bromine in the world continues to be controlled by the associated American producers and by the Leopoldshall-Stassfurt Convention, which is operative for several years to come.

The greater proportion of the output of bromine in the United States continues to be derived from Michigan, and a description of the various brines of this State carrying bromine has been given in Water-Supply and Irrigation Paper No. 31.[a] During 1901 Michigan contributed 160,000 pounds of bromine in the form of potassium bromide, which, with the output of 54,875 pounds of liquid bromine, gave an aggregate production for the year of 214,875 pounds of bromine or equivalent potassium salt. The Midland companies still control the bromine industry of the United States, although a small quantity has been produced from the Saginaw bitterns. The Red Cross well at Big Rapids is being equipped to produce bromine, and a shaft is being sunk for rock salt just south of Detroit, where the deposit is said to be large and of good quality.

The following table gives the production of bromine in the United States from 1897 to 1901, inclusive, from which it may be seen that Michigan is the most important producer, followed by West Virginia, Pennsylvania, and Ohio.

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[a] Lower Michigan mineral waters, a study into the connection between their chemical composition and mode of occurrence, by Alfred C. Lane: Water-Supply and Irrigation Paper U. S. Geol. Survey No. 31, 1899.

Production of bromine in the United States from 1880 to 1901, inclusive.

Year.	Michigan.	Ohio.	Pennsylvania.	West Virginia.	Total.	Value.	
						Total.	Cents per pound.
	Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*		
1880	....	....	....	....	404,690	$114,752	28
1881	....	....	....	....	300,000	75,000	25
1882	....	....	....	....	250,000	75,000	30
1883	....	....	....	....	301,100	72,264	27
1884	....	....	....	....	281,100	67,464	25
1885	....	....	....	....	320,000	92,800	29
1886	....	....	....	....	428,334	141,350	33
1887	....	....	....	....	199,087	61,715	31
1888	....	....	....	....	307,386	95,290	31
1889	....	....	....	....	418,891	125,667	30
1890	59,696	101,813	108,154	118,183	387,847	104,719	27
1891	47,320	121,681	85,832	113,953	368,786	73,757	20
1892	43,864	135,683	92,978	104,142	379,480	64,512	17
1893	42,568	113,575	111,403	80,852	348,399	87,100	25
1894	29,116	146,501	100,623	103,304	379,444	98,655	26
1895	30,280	152,360	104,647	107,567	394,854	102,662	26
1896	42,000	212,850	154,600	149,835	559,285	113,070	26
1897	[a] 147,256	124,972	116,967	97,954	487,149	136,402	28
1898	[a] 141,232	106,860	119,998	118,888	486,978	136,354	28
1899	[a] 138,272	82,368	111,150	101,213	433,003	125,571	29
1900	[a] 210,400	91,182	105,592	114,270	521,444	140,790	27
1901	[a] 217,995	125,467	101,595	106,986	552,043	154,572	28

[a] Including the bromine equivalent of the product recovered as potassium bromide.

BORAX.

By Joseph Struthers

PRODUCTION.

There was a slight decrease in the production of borax in the United States during 1901, the output being 17,887 short tons of crude borax, valued at $314,811, and 5,344 short tons of refined borax, valued at $697,307, with a total value of $1,012,118, as compared with the production of 24,235 short tons of crude borax, and 1,602 short tons of refined borax in 1900. Of the output in 1901, California produced 16,887 short tons of crude borax, valued at $297,198, and the total quantity of refined borax.

The production of borax in the United States continues to be derived mainly from the colemanite deposits of California, although a small quantity is produced from the marsh deposits of California, Nevada, and Oregon.

IMPORTS.

The following table gives the imports of borax and borates into the United States from 1899 to 1901, inclusive:

Imports of borax and borates into the United States from 1899 to 1901, inclusive.

Year.	Borax.		Borates, calcium, and sodium (crude and refined sodium borate).		Boric acid.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Pounds.		*Pounds.*		*Pounds.*	
1899	51,221	$3,508	42,165	$2,979	582,002	$20,560
1900	273,706	9,937	58,294	5,306	473,251	17,436
1901	515,046	20,643	103,700	9,411	725,005	26,629

OPERATIONS IN STATES.

California.—New methods of working low-grade mud deposits near Daggett were introduced during 1901, and a modern plant has been constructed by the Western Mineral Company which will increase its capacity to a considerable extent. The product is a boric acid concentrate, which is shipped East as a crude material for the manufacture of borax. The Standard Sanitary Company, of Pittsburg, Pa., has absorbed the Columbia Chemical Company, and the large mud deposits near Daggett, together with the extensive plant in that town formerly operated by the Columbia Chemical Company, are now under the control of the American Borax Company. New machinery has been added to the plant and its capacity largely increased through the substitution of the air method for the steam method formerly used in the manufacture of sulphurous acid. A railroad has been built from the mines to the works, a distance of 6 miles, and extensive arrangements have been made to handle large quantities of low-grade borate ores. The boric-acid concentrate produced will be consumed mainly by the company's works at Pittsburg for the manufacture of boric acid. It is worthy of note that this is the first determined effort to work low-grade deposits of calcium borate ores in this country. Considerable development work has been done at the Ventura colemanite mine owned by the Stauffer Chemical Company, and upward of 100 tons of high-grade calcium borate are produced per month for manufacturing into boric acid at the factories of the company in San Francisco. There have been no new borate deposits discovered during the year. The Pacific Coast Borax Company has heretofore supplied nearly the entire demand for borax in the United States, as well as a portion of the boric acid. The colemanite mines at Borate, 12 miles northeast of Daggett, owned by this company, continue to produce sufficient ore to supply the market, although the greater depth of the mining operations has increased the cost of extraction. The Pacific Coast Borax Company practically controls the borax market in the United States, and wise conservatism has been shown by its action in not increasing prices during the recent period of high values. The burning of the company's large factory at Bayonne, N. J., in April, 1902, has had no effect on the market, nor even required the reopening of the plant at Alameda, Cal. There is no immediate prospect of any decided increase in the production of calcium borate nor of any change in its price.

Oregon.—The marsh deposits of sodium borate in Harney County, which extend over 10,000 acres south of Lake Alvord, have been operated during the last few years, and the refineries have produced a yearly output of approximately 400 short tons of refined borax, which is carried by mules to Winnemucca, on the Canadian Pacific Railway, whence it goes to Chicago, St. Louis, and, occasionally, to San Francisco. The Rose Valley Borax Company owns 2,000 acres of the richest portion of the deposit close to the lake. The ground is level and treeless and is incrusted with a layer of sodium borate several inches in thickness, which contains also sodium carbonate, sodium sulphate, sodium chloride, and other salts. During the summer the loose surface deposit is shoveled into small heaps and is replaced by a second incrustation within a comparatively short time. As no mining is done in winter, sufficient material is collected in summer to furnish a supply to operate the refining works throughout the entire year. The crude mineral, containing from 5 to 20 per cent of boric acid, is shoveled into tanks of boiling water, and chlorine or sulphuric acid is added to decompose the alkali salts, and thus free the boric acid. After twenty-four hours the clear supernatant liquor is drawn off into crystallizing tanks and cooled, yielding white pearly scales of high-grade boric acid and a mother liquor, which is used repeatedly if it contains a sufficient quantity of sodium salts to warrant a separate treatment.

PRODUCTION IN OTHER COUNTRIES.

The Borax Consolidated, Limited (the international borax combination), now operating in the United States, England, France, and South America, reports a very favorable business for the fiscal year ending September 30, 1901. This company is capitalized at £1,400,000, of which £800,000 is preferred stock, carrying 5½ per cent cumulative dividends, and £600,000 is ordinary stock, each of a par value of £10. The net profits for the fiscal year were £190,278, from which interim dividends of £22,000 on preferred stock and £30,000 on ordinary stock (£52,000 in all) were paid. The balance of £138,278, together with the £13,360 brought forward from the previous year, gives a total surplus of £151,638.

Argentina.—The International Borax Company operated the Tres Moros mines during 1901, employing 500 laborers, and produced on the average 700 tons per month. The shipments from the province of Salta to Europe during the year exceeded 16,000 tons.

Chile.—Borax and boracite are found principally in the districts of Ascotan and Carcota, province of Antofagasta, although other deposits occur in the department of Copaipo, province of Antacama. The deposits of Ascotan and Carcota, which were worked for a long time by a Chilean company, are now under the control of a California company. During 1900 these mines produced 13,176 metric tons of calcined boracite and 26 metric tons of borax. The borax property, known as the Barateras de San Juan de Dialogue, has been recently purchased by a syndicate for $150,000.

Russia.—Borax is found on the Kertch and Taman peninsulas of southern Russia, where it occurs in connection with mud volcanoes. Soon after eruption the mud becomes incrusted with various salts, including borax, soda, and salt, which are recovered by dissolving in water and subsequent evaporation.

Turkey.—The mineral borocalcite, a calcium borate in Asia Minor, furnishes the base for the manufacture of the greater part of the borax supply of Europe. The crude mineral is treated with caustic soda, forming borax and calcium carbonate, although the best results are obtained by using a mixture of caustic soda and sodium bicarbonate. The ore is finely crushed in a mill, and 15 parts of mineral are placed in a steam-heated boiler with 60 parts water, 8 parts sodium bicarbonate, and 2 parts caustic soda, the whole being boiled for about three hours. The resultant liquor is filtered, and the hot filtrate yields at the end of several days crystals of borax, which are steam dried, assorted, and barreled. The cake of calcium carbonate remaining in the filter press is washed with water until the borax content is completely extracted, and is then sold to glass, paper, and cement works. It is estimated that 100 pounds of borocalcite will yield from 100 to 105 pounds of borax crystals.

PRICES.

There has been but little fluctuation in the price of borax during 1901, which has remained at 7 to 7.25 cents for the refined and 6.75 to 7 cents for the concentrated product. This latter grade, however, is not of uniform quality and is gradually disappearing from the market.

WORLD'S PRODUCTION.

The following table gives the production of borax and boron compounds in the principal countries of the world from 1896 to 1900, inclusive:

The world's production of borates, etc., from 1896 to 1900, inclusive.[a]

[Metric tons.]

Year.	United States. Calcium borate.	Chile. Calcium borate.[b]	India. Borax.[b]	Germany. Boracite.	Italy. Boric acid, crude.	Peru. Calcium borate.[b]	Turkey. Pandermite.[b c]
1896	12,310	7,486	340	184	2,616	1,179	12,626
1897	17,600	3,168	280	198	2,704	11,850	11,375
1898	13,911	7,034	184	230	2,650	7,178	([d])
1899	21,834	14,951	([d])	183	2,674	7,638	([d])
1900	23,456	13,177	([d])	232	2,491	7,080	([d])

[a] From official reports of the respective countries except the United States.

[b] Exports.

[c] Fiscal years.

[d] Not reported.

MICA.

By JOSEPH HYDE PRATT.

OCCURRENCE.

There occur in nature two varieties of mica that have commercial value—muscovite and phlogopite. The muscovite mica is that which is more commonly found and mined. This mica is very widely distributed, being a component part of many of the crystalline and sedimentary rocks. Its principal value, however, is due to its occurrence in blocks or masses that are capable of being split into sheets a square inch or more in size, and the value of these sheets increases with their size, which varies from 1 by 1 inch to 8 by 10 inches. Although mica is a common rock constituent, the commercial deposits occur, for the most part, in pegmatitic dikes or veins, which are found in granite and in hornblende and mica-gneisses and schists. The thickness of these dikes or veins varies from a few inches to several hundred feet, and the dikes are often very irregular, having arms or "veinlets" branching off from them in many directions. Sometimes they are parallel to the bedding or schistosity of the gneiss or schist; at other times they break across these at varying angles.

In character these pegmatitic dikes are very similar to granite—they have sometimes been called "coarse granite"—and if we could conceive of the constituents of granite as being magnified a hundred times or more we should have an appearance that would be very similar to that of one of these dikes. Their mineral constituents consist principally of quartz, feldspar, and mica, in varying proportions. In some parts of the dike or vein the quartz and feldspar are nearly equally distributed, and sometimes one and then the other will predominate. Feldspar has been observed that has crystallized out in masses of more than a ton in weight, and well-developed crystals of this mineral have been found that were 1½ by 3 feet. Sometimes the feldspar, quartz, and mica have separated out on a rather small scale; at other times they occur in large masses. In general it may be said that the veins that yield the best mica are those in which these minerals have crystallized in the larger masses. Thus, where the feldspar and quartz are in small masses the mica blocks are apt to be so small that no plate mica can be cut from them. All the mica dikes or veins do not contain mica that would be of value for cutting into plates, and usually dikes 2 feet or less in width are barren of any that would have commercial value, except as scrap mica. On the other hand, all the wider veins do not carry mica that would make profitable mining, for in some the mineral is in such small crystals and blocks that no plates can be obtained over a square inch or two in size. Mica as it occurs in the vein is usually in rough crystals, called blocks or books, sometimes distributed evenly throughout the vein, at other times nearer the contact of the vein with the country rock.

Occasionally these blocks are nearly perfect in their crystalline form, which is monoclinic, but rhombic or hexagonal in outline. The blocks usually vary from 1 to 18 inches in thickness and from 3 to 15 inches in diameter; but they have been found occasionally with a diameter of 4 feet. In some of the veins the blocks are found to have been converted into what is known as "ruled mica," which is split into narrow strips whose edges are parallel to the intersection of the prism and base edges of the crystal; or they have been converted into "A" mica, in which the sheets are striated on two adjacent edges.

The percentage of mica contained in these pegmatitic dikes will seldom average over 10 per cent of the contents of the dike when it is estimated for any considerable distance. The dikes will often have the appearance of containing a very much larger percentage on account of the number of blocks of mica clustered together in bunches and almost touching one another in a particular portion of the dike; but in other portions of this same dike there may be an absence of mica for a distance of 5 to 20 feet, thus bringing the general average of the mica down to 10 per cent or under. Pegmatitic dikes have been observed in which cross sections in certain parts showed nearly 90 per cent of mica, the feldspar and quartz being almost entirely wanting; but this condition lasted for only a few feet, and wherever it has been observed the mica blocks have been small, so that it was of value only as scrap mica. Probably not over 10 or 15 per cent of the mica mined is capable of being cut into plates, the rest being waste or scrap mica. In some of the mines in the Western part of the United States there is hardly a 3 per cent yield of plate mica. The product of the North Carolina mines will probably average the highest percentage of plate mica. There are a number of reasons for this large percentage of waste and for the irregularity of the blocks and the individual sheets; for example, the reduction by the "ruled" and the "A" mica of the sizes of sheets that can be cut from the block, the specked and stained condition of the mica, and the destruction of plate mica by having garnet, tourmaline, or quartz crystallize out between the folia.

USES.

There has been a decided decrease in the use of mica required for cutting into sheets of the various sizes used for stoves, chimneys, incandescent lights, etc.; but there has been a large increase in the quantity of the smaller pieces of mica that are cut by machinery into small circular disks 1 inch in diameter, and into rectangular pieces three-fourths of an inch by 2 inches, which are used for insulation purposes and for electrical apparatus. Some of the small, clear pieces obtained in cutting up the large sheets are split very thin and rearranged and cemented and firmly pressed together, forming large sheets, which are then cut into the various shapes and sizes desired. Sheets made in this way are known as micanite. For some purposes these large sheets of micanite answer fully as well as the natural sheets, and are of course much cheaper. The waste or scrap mica which is not suitable for any of the above purposes has a value, when ground, in the manufacture of wall papers, lubricants, etc. Another use for scrap mica that has been devised during the last few years is for the manufacture of a covering for boiler tubes and steam pipes in general. The scraps of mica are not ground, but are broken to approximately the same general dimension, about one-half by one-quarter of an inch. These pieces of mica are arranged with their longest direction and face parallel to a wire net coil pressed into the shape of the pipe or tube, the layer of mica being kept tightly in place against this coil by means of heavy canvas. This kind of boiler-tube covering can be made cheaply, and as mica is a nonconductor of heat, it should give almost as good satisfaction as asbestos covering. North Carolina offers a very favorable location for a plant to manufacture these boiler-tube coverings, as it can produce a large supply of scrap mica and has also an abundant supply of available waterpower. The commercial value of this scrap mica, which is from $8 to $10 per ton delivered at the railroad, has made it possible to work some of the mica mines that would otherwise have been unprofitable, for in some cases the waste or scrap mica represents from 75 to 95 per cent of the mica obtained.

PRODUCTION

Mica has been found in many of the States, but in only a few has the occurrence been of commercial value. In the last few years mica has been mined in the following States: Alabama, Arizona, California, Colorado, Connecticut, Idaho, Maine, Missouri, Nevada, New Hampshire, New Mexico, New York, North Carolina, Rhode Island, South Dakota, Virginia, and Wyoming. During 1901, however, the only States that reported any production of mica were New Hampshire, New Mexico, North Carolina, and South Dakota, by far the larger amount being obtained from North Carolina.

The total amount of plate mica produced in the United States during the year 1901, as reported to the Survey, was 360,060 pounds, valued at $98,859, as compared with 456,283 pounds, valued at $92,758, in 1900. During the last two years there has been a large increase in the amount of mica produced, with, however, but a slight increase in value, a condition which is undoubtedly due to the very large amount of small-sized mica disks and rectangular sheets that have been cut for electrical purposes, and that, in former years, had been used as scrap mica. Some of this plate mica has been obtained from old mica dumps. There was a large falling off in the amount of scrap mica produced in 1901, which has been estimated as 2,171 short tons, valued at $19,719, as compared with 5,497 tons, valued at $55,502, in 1900. This falling off in the production of scrap mica is undoubtedly due to the exhaustion of the large piles of scrap that had accumulated during the last quarter of a century, when there was a market only for plate mica.

In the following table is shown the annual production of mica in the United States since 1880:

Production of mica since 1880.

Year.	Quantity.	Value.	Year.	Quantity.	Value.
	Pounds.			*Pounds.*	
1880	81,669	$127,825	1895 Sheet	44,325	$55,831
1881	100,000	250,000	1895 Scrap	[a]148	
1882	100,000	250,000	1896 Sheet	49,156	65,441
1883	114,000	285,000	1896 Scrap	[a]222	1,750
1884	147,410	368,525	1897 Sheet	82,676	80,774
1885	92,000	161,000	1897 Scrap	[a]740	14,452
1886	40,000	70,000	1898 Sheet	129,520	103,534
1887	70,000	142,250	1898 Scrap	[a]3,999	27,564
1888	48,000	70,000	1899 Sheet	108,570	70,587
1889	49,500	50,000	1899 Scrap	[a]1,505	50,878
1890	60,000	75,000	1900 Sheet	456,283	92,758
1891	75,000	100,000	1900 Scrap	[a]5,497	55,202
1892	75,000	100,000	1901 Sheet	360,060	98,859
1893 Sheet	51,111	88,929	1901 Scrap	[a]2,171	19,719
1893 Scrap	[a]156				
1894 Sheet	35,943	52,388			
1894 Scrap	[a]191				

[a] Short tons.

The relatively small production of mica can be accounted for by the low prices maintained for plate mica, by the uncertainty of the occurrence of the mica in the veins, and by the large number of small producers who are entirely dependent upon one small mine, and who, when the mica in this begins to give out or is poor, have not the means to carry on much dead work, and have no other deposit to help fill out this deficiency. The consolidation of a number of the mica mines in different sections might be profitable. The importation of mica from Canada and India at a low valuation tends also to curtail the production of mica in the United States. This is especially true of the mica imported from India, which can be mined and landed in this country at a lower price than, in some cases, it can be mined in the United States.

The production of mica during 1900 and 1901, by States, is given in the following tables:

Production of mica in 1900, by States.

State.	Sheet mica.	Scrap mica.
	Pounds.	*Short tons.*
New Hampshire	191,118	645
North Carolina	107,255	4,450
South Dakota	[a] 123,090	80
New Mexico	9,620	258
Virginia	16,000	....
Other States [b]	9,200	64
Total	456,283	5,497

[a] Sold in rough or unmanufactured condition.

[b] Idaho, Maine, Nevada, and Rhode Island.

Production of mica in 1901, by States.

State.	Sheet mica.	Scrap mica.
	Pounds.	*Short tons.*
New Hampshire	65,800	250
New Mexico	3,100	146
North Carolina	266,160	1,775
South Dakota	25,000	....
Total	360,060	2,171

As is seen from the above tables, Idaho, Maine, Nevada, Rhode Island, and Virginia, which were producers of mica in 1900, had no production during 1901, and there was a very noticeable falling off in the production of the other States, with the exception of North Carolina. In North Carolina there was a decided increase in the production of plate mica, but a large falling off in the production of scrap mica. Extensive development work is being conducted by the Union Mica Company at its property on Black Mountain, near Rumford Falls, Me. The vein as exposed carries a large percentage of mica; little of it, however, is suitable for cutting into plates, but most of it will be used as scrap. Development work is also being done near Oxford, Me., and North Sherburne, Vt., and all these localities will probably be producers in 1902.

IMPORTS.

Nearly all of the mica imported into the United States is obtained from India and Canada, by far the larger proportion being from India; and since 1897 there has been a constant increase in the amount entered from India for consumption into the United States. In the following table are given the imports of unmanufactured mica from 1869 to 1896:

Value of unmanufactured mica imported and entered for consumption in the United States, 1869 to 1896, inclusive.

Year ending—	Value.	Year ending—	Value.	Year ending—	Value.
June 30—		June 30—		Dec. 31—	
1869	$1,165	1879	$9,274	1888	[a] $57,541
1870	226	1880	12,562	1889	[a] 97,351
1871	1,460	1881	5,839	1890	[a] 207,375
1872	1,002	1882	5,175	1891	95,242
1873	498	1883	9,884	1892	218,938
1874	1,204	1884	28,284	1893	147,927
1875	....	1885	28,685	1894	126,184
1876	569	Dec. 31—		1895	174,886
1877	13,085	1886	[a] 56,354	1896	169,085
1878	7,930	1887	[a] 49,085		

[a] Including mica waste.

Under the new classification made necessary by the Dingley tariff act, in effect from and after July 24, 1897, mica is designated as "unmanufactured" and "cut or trimmed." A specific import duty of 6 cents per pound is imposed upon the former and 12 cents per pound upon the latter, with an additional 20 per cent ad valorem duty on each. The imports, after the new classification took effect, for the years 1898, 1899, 1900, and 1901, were as follows:

Mica imported and entered for consumption in 1898, 1899, 1900, and 1901.

Year.	Quantity.	Value.	Year.	Quantity.	Value.
1898.	*Pounds.*		1900.	*Pounds.*	
Unmanufactured	877,930	$115,930	Unmanufactured	1,892,000	$290,872
Cut or trimmed	78,567	34,152	Cut or trimmed	64,391	28,688
Total	956,497	150,082	Total	1,956,391	319,560
1899.			1901.		
Unmanufactured	1,709,839	233,446	Unmanufactured	1,598,722	299,065
Cut or trimmed	67,293	42,538	Cut or trimmed	78,843	35,989
Total	1,777,132	275,984	Total	1,677,565	335,054

FLUORSPAR AND CRYOLITE.

By Joseph Hyde Pratt.

FLUORSPAR.

OCCURRENCE.

Fluorite or fluorspar is a calcium fluoride that is generally found in veins in limestones, sandstones, mica-slate, clay slate, and gneiss. Where it occurs in commercial quantity, it is usually in cleavable masses of a white, greenish-white, or pale-green color. Where any small openings exist in the vein the fluorspar occurs in well-developed cubical crystals, and is usually highly colored with various tints of purple, varying from a pale amethyst to an almost black purple. This is very apt to be the case where the fluorspar is associated with metallic minerals. Fluorspar also occurs commonly as the gangue of many metallic ores, especially of lead.

Although this mineral has been found widely distributed throughout the United States, there are but few localities where it has been found in sufficient quantity for commercial purposes. Until 1898 the only source of fluorspar in the United States was the mines in Hardin and Pope counties, southern Illinois.[a] These deposits occur in Lower Carboniferous limestones in fissure veins, which at the time of their formation were narrow. The greater width of the fluorspar veins as they are now found is undoubtedly due to the partial replacement of the limestone. It is also very probable that the original crevices were enlarged by circulating waters, which, under certain conditions, would at one time take material into solution and at another time would deposit it. The foot wall of these veins, as far as observed, is limestone, and the fluorspar is often found in a solid mass from 2 to 12 feet in thickness.

There is frequently found also more or less calcite (calcspar), which grades gradually into the fluorspar. On the hanging-wall side of the vein the fluorspar contents are not pure, and are often composed of the spar and fragments of country rock material. There is also a gradual gradation from the solid fluorspar, so that there is no sharp contact of the vein. It may be that there are parallel crevices, which would be encountered by crosscutting through this hanging wall. A total width of 45 feet has been observed in some of these veins. Associated with the fluorspar and calcspar in these veins are galena, sphalerite (zinc blende), and now and then a little pyrite and chalcopyrite. Barite has occasionally been detected in very small amounts. The depth to which these deposits extend can not be definitely determined, but as they have been worked already to a depth of 200 feet without any apparent diminution in the width of the vein, it seems reasonable to assume, as stated by Mr. S. F. Emmons,[a] that they will extend "at least as far down as the Trenton and Cambrian limestone. The mineral contents of the fissure, however, may be expected to vary with the character of the inclosing beds, and to diminish very much, if not to be cut off entirely, when the walls are formed by more siliceous and hence less readily soluble rocks." The workable deposits are located for the most part from a quarter to half a mile northwest of Rosiclaire, Hardin County, which is on the Ohio River. The actual amount of fluorspar in these deposits is very large, and more than sufficient to supply the demand for many years to come; but as the mining extends deeper, water has to be contended with, which makes it expensive.

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[a] Am. Inst. Min. Eng., Vol. XXI, 1892-93, p. 31.

This same general geological formation extends over into western Kentucky, and in 1898 deposits of fluorspar were discovered in Crittenden and Livingston counties in Kentucky. These deposits are centered around Salem, Livingston County, and Marion, Crittenden County.[b] The fluorspar occurs in fissure veins like those in Illinois, and the associated minerals are the same. These deposits have been pretty thoroughly developed, so that their production now exceeds considerably that of the Illinois deposits. A small amount of fluorspar is also obtained from Caldwell County, Ky.

Both the Illinois and the Kentucky deposits are worked by means of shafts and drifts. As the crude material is taken from the mine, it is in a number of cases concentrated by a hand-cobbing machine and by the use of water jigs. In some cases after being washed it is shipped as it comes from the mine. In a number of cases by-products are obtained, as galena, which is saved by the Rosiclaire Lead and Fluorspar Company, the largest operators of the mines in Illinois, and as zinc carbonate, obtained by the Chicago Mining Company from their mines in the vicinity of Marion, Crittenden County, Ky. The Kentucky Fluorspar Company, the Fluorspar Company, and the Western Fluorspar Company have opened mines in Crittenden County, Ky., and are now producers of this mineral. The Eagle Fluorspar

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[a] Am. Inst. Min. Eng., Vol. XXI, 1892-93, p. 51.

[b] Mineral Industry, Vol. IX, 1900, p. 293.

Company are producing from deposits in both Crittenden and Livingston counties, and are using the Hooper pneumatic concentrator in their concentrating plant.

Fluorspar deposits have recently been discovered in Smith, Trousdale, and Wilson counties, Tenn., and the Tennessee Fluorspar and Mining Company has been incorporated to work deposits near Bellwood, Smith County. These were partially developed in 1901, but no ore was shipped.

In the vicinity of Dome, Yuma County, Ariz., fluorspar occurs abundantly as a gangue mineral in many of the veins of that district. It is found from a few inches to 7 feet or more in width, and, as has been noted by the miners in the district, the pay streak stays with the fluorspar. Some of the fluorspar occurs in beautiful crystals—green, blue, purple, and pink in color. If the demand for the use of this mineral for smelting purposes increases there will be a market for these Arizona deposits.

USES.

Formerly the chief use of fluorspar was in the preparation of hydrofluoric acid, which is obtained by the action of sulphuric acid on the fluorspar, producing hydrofluoric acid and calcium sulphate, but this is now probably one of the smallest uses of this mineral. It has been estimated that only from 5 to 10 per cent of the fluorspar mined is now used in the manufacture of this acid. Fluorspar is used in the manufacture of opalescent glass, which use is increasing, and it is considered very essential for this purpose. The spar that is used for the manufacture of this glass is cleaned, ground, and bolted, and then used in this condition, so as to give as much surface to the spar as possible, thus obtaining a quicker chemical reaction. By far the largest amount of fluorspar is used in fluxing iron. It possesses superior qualities that make it especially adapted to this purpose, and some of its advantages that are enumerated by the Fluorspar Company are that it will save from 3 to 5 per cent more iron than limestone flux; that it will reduce the sulphur and phosphorus contents; that it will increase the tensile strength of iron and steel; that it will increase the capacity of the furnace; that it will save fuel; that it will make a more fluid slag, and will consequently keep the furnaces and cupolas cleaner. Its property of facilitating the reduction of the most different bodies makes it a valuable flux in the production of spiegeleisen. It carries the phosphorus into the basic slag, and although this property of fluorspar has not been of any special importance thus far in the production of pig iron, it has been utilized in dephosphorizing pig iron in basic-lined cupola furnaces. In foundry work the use of fluorspar is very rapidly increasing, and it is superseding limestone. In the cupola furnace the limestone serves only to slag the ashes of the fuel and has no beneficial chemical effect on the iron, but the fluorspar affects the iron by keeping it gray and soft, by keeping the silicon as an alloy, and by removing some phosphorus and sulphur into the slag.

Fluorspar can probably be used to advantage in copper smelting, and also for reducing many of the other metals. Where copper ore contains nickel the fluorspar can be used to advantage for the collecting of the nickel in the matte. It is also of value in removing silicon and arsenic. This is especially true in the refining and resmelting of copper.

The hindrances to the use of fluorspar for fluxing purposes have been the higher cost of this flux as compared with limestone, the inaccessibility of the deposits, the uncertainty of the production, and the action of the slag and gases on the lining of the furnaces.

The discovery of the Kentucky deposits and the quantity that is known to exist in these and in the Illinois deposits should remove all question as to a constant supply of this mineral. These deposits are accessible to transportation by railroad and water. The deposits of Arizona, although they are not now being worked, would be accessible for use in copper smelting in that section. By using chromite (chromic iron ore) in the construction of the linings of furnaces a lining can be made which would be affected but little by the use of fluorspar.

While the larger proportion of the fluorspar mined is now being used in steel works, there is but very little used in blast furnaces and in the smelting of copper or other metals. In foundry work the use of fluorspar will increase very rapidly as it is more thoroughly appreciated.

PRODUCTION.

The total production of fluorspar in 1901 was 19,586 short tons, valued at $113,803, as compared with 18,450 tons, valued at $94,500, in 1900. The great increase in value was due to the larger amount of ground fluorspar sold. Of this total production 15,886 tons was crude fluorspar, which was shipped in bulk, and was valued at $79,703; in 1900 the amount of crude fluorspar sold was 15,450 tons, valued at $77,500. This is an increase of 436 tons in production of crude fluorspar and of $2,203 in value. The average price per ton reported for the product of 1901 was $5, the same as in 1900. The amount of ground fluorspar sold in 1901 was 3,700 tons, valued at $34,100, as compared with 3,000 tons, valued at $17,000, in 1900; an increase of 700 tons in amount, but of $17,100 in value. This large increase in value is due to the low price reported for ground fluorspar in 1900, which was but $5.66 per ton, only 66 cents more than the average price reported received for the crude fluorspar. In 1901 the average price reported for the ground fluorspar was $9.22, which is $4.22 per ton more than the crude fluorspar, and probably comes nearer representing the relative value of the ground and the crude fluorspar.

The increased use of fluorspar for metallurgical purposes should cause a considerable increase in the production of the crude material. In the table below is shown the annual production of fluorspar since 1882.

Production of fluorspar in the United States from 1882 to 1901, inclusive.

Year.	Quantity.	Value.	Year.	Quantity.	Value.
	Short tons.			*Short tons.*	
1882	4,000	$20,000	1892	12,250	$89,000
1883	4,000	20,000	1893	12,400	84,000
1884	4,000	20,000	1894	7,500	47,500
1885	5,000	22,500	1895	4,000	24,000
1886	5,000	22,000	1896	6,500	52,000
1887	5,000	20,000	1897	5,062	37,159
1888	6,000	30,000	1898	7,675	63,050
1889	9,500	45,835	1899	15,900	96,650
1890	8,250	55,328	1900	18,450	94,500
1891	10,044	78,330	1901	19,586	113,803

The records of the Bureau of Statistics of the Treasury Department do not make any separate statement of fluorspar imported into the United States, and it is included among minerals and ores not elsewhere specified.

CRYOLITE.

OCCURRENCE.

Cryolite is a fluoride of sodium and aluminum which in appearance somewhat resembles ice. It occurs in quantity in great snow-white masses which are partially transparent. Its hardness is 2.5, and it has three cleavages. It is obtained exclusively from Ivigtok, in Greenland, on the Arksuk Fiord, one of the deep, rocky, winding bays which penetrate the steep mountain coast at intervals. It constitutes a large bed in a granitic vein in gray gneiss. The cryolite is limited to the granite, and the richer portion is about 500 by 1,000 feet in area. Associated with the cryolite in small amounts are quartz, beautiful crystals of siderite and galena, smaller amounts of sphalerite, pyrite, chalcopyrite, and wolframite, which are irregularly scattered through the cryolite. Surrounding this richer portion there is a zone where the chief minerals are quartz, feldspar, and avigtite, a variety of muscovite-mica. Besides these, there are fluorite, cassiterite, and arsenopyrite, all of which are in a kind of basic groundmass of cryolite. Between this outer zone and the main mass of the cryolite the contact is rather sharply defined; but there is no distinct boundary between the outer zone and the surrounding granite into which it passes. The mineral is mined by open cuts and forms a quarry that is about 600 feet in length by 200 in width and 100 feet or more in depth. Whole cargoes of mineral that were 99.5 per cent pure cryolite have been obtained from the inner and deeper portions of the quarry.

USES.

Cryolite is used sparingly in the manufacture of hydrofluoric acid, its greatest use being in the manufacture of aluminum and sodium salts. In the manufacture of these salts from cryolite, the mineral is first dried and then reduced to a fine powder and intimately mixed with powdered limestone. This mixture is then calcined, in which process the fluorine unites with calcium to form calcium fluoride, which is insoluble in water, while the sodium and aluminum are oxidized and form probably a soluble aluminate of sodium and a carbonate of sodium. By leaching with hot water the aluminate of sodium and the carbonate of sodium are removed. Carbon dioxide gas is forced into the tanks containing these solutions, which are kept constantly agitated, and the aluminum is precipitated as aluminum hydroxide, and the sodium forms sodium carbonate. After the precipitate has settled in the settling tanks, the solution containing the sodium carbonate is drawn off, further evaporated, and then passed into large pans, each of about 50 tons capacity, where the solution is evaporated to its maximum degree of concentration, and is then drawn off into the crystallization pans, where the sal soda is allowed to crystallize. The aluminum hydroxide precipitate is washed to free it from traces of sodium carbonate, and, after drying, it is either sold in this rough form or it is manufactured into the sulphate of aluminum, or alum.

Cryolite is also used to a limited extent in the manufacture of an opalescent glass which resembles French porcelain. This glass is made from a mixture composed of two parts of powdered cryolite and one of sand (silica), with one-half an equivalent portion of zinc oxide. The resulting opalescent glass is extremely hard and tough, and it is stated that it can be worked as easily as ordinary glass.

PRODUCTION AND IMPORTS.

There is no cryolite produced in the United States, and it has been found very sparingly in only a few localities in this country: at the southern base of Pikes Peak, El Paso County, Colo., and in the Yellowstone National Park. All of the cryolite used is imported from Ivigtok, Greenland, and the supply is controlled by the Danish Government. There is imported each year into the United States from 5,000 to 10,000 tons.

In the following table are shown the imports of cryolite since 1871:

Imports of cryolite from 1871 to 1901.

Year ending—	Amount.	Value.	Year ending—	Amount.	Value.
June 30—	*Long tons.*		Dec. 31—	*Long tons.*	
1871		$71,058	1886	8,230	$110,152
1872		75,195	1887	10,328	138,068
1873		84,226	1888	7,388	98,830
1874		28,118	1889	8,603	115,158
1875		70,472	1890	7,129	95,405
1876		103,530	1891	8,298	76,350
1877		126,692	1892	7,241	96,932
1878		105,884	1893	9,574	126,688
1879		66,042	1894	10,684	142,494
1880		91,366	1895	9,425	125,368
1881		103,529	1896	3,009	40,056
1882	3,758	51,589	1897	10,115	135,114
1883	6,508	97,400	1898	6,201	88,501
1884	7,390	106,029	1899	5,879	78,676
Dec. 31—			1900	5,437	72,763
1885	8,275	110,750	1901	5,383	70,886

ASBESTOS.

By Joseph Hyde Pratt.

OCCURRENCE.

There are two distinct minerals that are mined and sold under the name of asbestos; one is a variety of amphibole, a silicate of calcium and magnesium, and the other is a variety of serpentine known as chrysotile, a hydrous magnesium silicate. These are similar in their physical properties, but, though they are about equal in their heat-resisting properties, the chrysotile variety is superior in strength and elasticity of fiber to any amphibole asbestos, and for this reason it is used for many purposes for which the amphibole variety is not adapted. The chrysotile asbestos is usually greenish white, green to yellowish in color, with very flexible fibers, which are easily separated from one another and have a decidedly silky luster. These fibers are short, seldom over 2½ inches long, usually from half an inch to 1½ inches. The fibers of the amphibole variety are usually much longer, and some have been found that were 3 feet long. The fibers are usually easily separated, but sometimes they are so thoroughly mixed with siliceous material that it is necessary to crush the pieces before the fibers can be pulled apart. They do not have the silky luster and appearance of the chrysotile variety, but are more like flax. The color varies from white to grayish to greenish white.

The amphibole asbestos is usually found in granitic or schistose rocks, sometimes in pockets, and again in well-defined veins; and the chrysotile variety is found in seams of varying width in serpentine rocks. As the chrysotile asbestos can be used for so many more purposes than the amphibole variety, there is of course a correspondingly larger demand for it; but as the other in its occurrence is usually more constant and can be mined with less expense, the cleaned product is cheaper, and there is a considerable demand for it for those purposes where its nonconductivity of heat is the principal quality desired, and for these purposes it serves as well as the chrysotile asbestos.

There are a number of localities where the amphibole asbestos occurs in quantity, but at the present time the deposits at Sall Mountain, White County, Ga., are the only producers. These deposits are located at Santee, 12 miles northwest of Clarkesville, near the Chattahoochee River. The material as it is mined is crushed, cleaned, and fiberized at the company's plant at the mine, and is then hauled to Clarkesville, which is on the Tallulah Falls Railroad, where it is shipped. At Northeast, Habersham County, Ga., a new asbestos deposit has been developed which promises an abundant supply of short fiber. On Tryon Mountain, Polk County, N. C., about 1½ miles west of Skyuka, amphibole asbestos has been found in what is apparently a series of pockets which have been traced across the country for nearly a mile. One pocket that was opened measured nearly 100 feet in width. It is of fair quality, and large masses have been taken out in which the fiber was from 10 to 15 inches long. This property is owned by Mr. D. Stearn, of Lynn, N. C. A promising occurrence has been found in Bedford County, Va., about 12 miles a little east of south of Bedford City, near Chestnutfork post-office, a short distance from the Rocky Mount turnpike.

Practically all the chrysotile variety of asbestos used in this country and Europe is obtained from the deposits at Black Lake and Thetford, near Sherbrooke, Ontario, Canada. The process of mining this asbestos is by means of open quarries, and at the Bell mine there is one pit that is several acres in area and about 150 feet deep. The serpentine is blasted out, and then the portions that contain the asbestos seams are separated from the barren rock by hand cobbing. It has been estimated that 2 tons of commercial asbestos are obtained from every 100 tons of rock which is crushed. In the preparation of the asbestos for market the rock from the cobbing rooms is transferred to breakers or crushers, and from them the coarser fragments are transferred to a set of rolls. From the rolls the crushed material is carried along on traveling belts to picking tables, from which the fragments of barren rock are picked off and thrown aside. From these tables the asbestos-bearing fragments are carried to (cyclone) pulverizers, in which the final crushing is performed and where the light asbestos fibers are separated by a current of air from the heavier rock. The longer fiber is separated from the fine dust and the finely broken fiber by screening. As these Canadian mines are taxed to their utmost in order to supply the demand of the market, any interruption of this supply causes at once a scarcity of the crude asbestos, and consequently there is an immediate increase in price. With the new uses to which asbestos is put, there is a constant increase in the demand for this mineral, and in order to meet it new sources of supply have been prospected for, with the result that there are now in the United States two or three localities that have been thoroughly developed, and one or two of them, at least, will become large producers of this material in 1902.

With the exception of the production of asbestos at the Sall Mountain mines in Georgia, the year 1901 has been what might be called a year of development work; for neither the Vermont nor the Wyoming chrysotile-asbestos deposits have been producers during this year, though they have been thoroughly developed, considerable ore has been taken out, and they will undoubtedly be producers of this mineral in quantity during 1902.

The Vermont deposits are located in the northern central part of the State, in the town of Eden, Lamoille County, and in the adjacent town of Lowell, Orleans County. The occurrence of these deposits has been described in considerable detail by Prof. J. F. Kemp in Mineral Resources, 1900, pages 862–866. The serpentine areas or belts extend for great distances to the north; but the existence of this serpentine is not indicative of the presence of asbestos; and up to the present time no definite discovery has been reported, except that in the belt on Belvidere Mountain, and even in this belt the asbestos is limited to a small area. There are two distinct varieties of asbestos in this belt. One is in veins which ramify through the serpentine in every direction; its fibers are perpendicular to the walls of the seams, and have a maximum length, as thus far observed, of three-fourths of an inch, varying from this down to not more than one-sixteenth of an inch. It is similar in all respects to the Canadian product, and is just as good in quality. The other variety occurs upon the slickensided surfaces that are common to serpentine, and the fibers form layers of varying thickness against these surfaces, and have been found varying in length from a fraction of an inch up to 3 or 4 inches. These seams or layers of fibers are seldom over a quarter of an inch in thickness; the fiber is usually coarser than that found in the veins, and will not furnish so good a grade of asbestos.

There are four companies operating in this vicinity—the New England Asbestos Mining and Milling Company, the National Mining and Development Company, the Tucker Asbestos Company, and the Vermont Asbestos Company. The most extensive work has been done by the New England Company, whose property is situated on the south side of Belvidere Mountain in the town of Eden. The outcropping of the serpentine ledge that carries the asbestos is about 150 rods square and varies in height from 25 to 150 feet. It is on the mountain side, about 2,000 feet above the valley. About 1 acre has been cleared of all trees and top soils at the point where the company has concentrated its operations. A complete mill for treating the rock and for preparing the asbestos for market has been completed and is so located that the cars from the mine can run by gravity into the tower of the mill, where the rock is at once dumped into the large crusher. The method adopted for working the deposit is by means of open cuts run into the side of the mountain; but after an advance of 350 feet, a soapstone (talc) ledge was encountered. The height of the cut at this point was 50 feet; and instead of continuing with the open cut, which would have been entirely within waste rock, the company cut a tunnel 10 feet high and 20 feet wide through this soapstone ledge. After penetrating this rock for 115 feet the rich asbestos seams were again encountered at a depth of 150 feet below the surface. A pit is now being sunk from the surface to meet this tunnel, and then the open cut work will be continued and the rock will be taken out from the surface down to this level. The slope of the mountain is very steep at this point, so that the height of the cut is rapidly increasing. This method of working the deposit permits of all the crude asbestos being delivered at the mill without any hoisting at all. The development work has blocked out a large amount of asbestos rock, and it is roughly estimated that there are about 20,000 tons of the rock on the dumps ready to be milled.

The National Mining and Development Company's property is located in the town of Eden, Lamoille County, on the southeasterly side of Belvidere Mountain, nearly due north of Eden post-office; and it adjoins the tract owned by the New England Company. The company's property has been developed to only a limited extent, and no work was done during the winter. The property will be thoroughly developed in the spring, and a mill erected for treating the asbestos rock, and the company confidently expects that before the close of 1902 it will be shipping the commercial asbestos.

The Tucker Asbestos Company's property is on the eastern slopes of Belvidere Mountain, in the southwestern part of Lowell Township, Orleans County, about 5 miles southwest from Lowell village, and 4 miles north from Eden mills, in the town of Eden, Lamoille County. The county line bounds one side of the property. The serpentine belt can be traced diagonally across the property in a northeast-southwesterly direction into the town of Eden, and it is at the extreme easterly end and near the foot of the mountain that most of the work of this company has been done. These deposits are also so located that they can be worked by means of open cuts starting in at the foot of the exposed ledge, and plans have already been made by the company for the erection in the spring of a mill to treat the rock.

The Vermont Asbestos Company's deposits are about 6 miles northeast of this exposure, and 2 miles northeast from Lowell village, in another serpentine belt, which is distinct from that at Belvidere Mountain. The ledge is exposed for about 200 rods in length, and runs nearly north and south. The asbestos occurs in seams or veins running in all directions through the rock. The property has not been as thoroughly developed as the others; but what has been done has given very good results, and this property will probably be equipped during the coming year with a plant for treating the asbestos rock.

The properties of the New England and the National companies are on the northern edge of the Belvidere Mountain serpentine belt, and near the outcrop of the hornblende-schist which forms the northern portion of the mountain; and the property of the Tucker Company is on the eastern edge and at a considerably lower elevation, and is, therefore, more within the serpentine formation itself. It is not improbable that larger veins of asbestos may be discovered than have thus far been exposed, but there is no way in which this can be determined except by the actual exposure of the veins themselves. There is, however, so far as can be judged, a sufficient quantity of good asbestos rock exposed to make the mining of it remunerative.

Known deposits of chrysotile asbestos are few; at the present time the only ones are those in Canada, Vermont, Wyoming, and California. As the first two of these are the only ones at which there has been any considerable amount of work done, there is no precedent from which to draw conclusions regarding the extent or the continuance of this kind of asbestos. As has been stated above, the existence of serpentine does not imply the presence of asbestos even in the general vicinity where chrysotile asbestos deposits have been found, and in these deposits themselves the veins are more or less erratic. It is therefore advisable in mining this mineral to keep a considerable quantity of the asbestos rock blocked out ahead. It will undoubtedly be found that the asbestos rock in the Vermont serpentines will be restricted to certain localities.

The Wyoming deposits are located in the vicinity of Casper, Natrona County, and they are now being thoroughly developed by the McConnell Asbestos Company of Pittsburg, Pa. The deposits are worked by means of large pits, and the company has during the past year been running a long tunnel to connect with one of their pits, so that it will not be necessary to hoist any of the asbestos rock or to require any hauling to the mill. With the completion of this tunnel the company will be in a position to produce asbestos, and they expect to do this during the early part of 1902. There are a number of other asbestos properties being developed by various persons in this same general vicinity.

In California there was but little asbestos mined during 1901, and the mining was confined to the deposits in Riverside County, operated by the Pacific Asbestos Company. Between Greenwood and Georgetown, Eldorado County, an asbestos prospect has been developed by Mr. E. H. Hadley, of Sacramento, Cal., that has shown the presence of seams of chrysotile asbestos aggregating 20 inches in width. In Calaveras County, in the vicinity of Copperopolis, is the Elva asbestos mine, which is owned by Mr. James C. Rasberry, of Angels Camp, Cal. This asbestos is a chrysotile variety, but it has been developed to only a limited extent. What work has been done, however, seems to point to a quantity of this material. All these California properties are so located that they can be worked by means of open cuts.

Chrysotile asbestos has also been mined to a limited extent in the town of Hinsdale, Berkshire County, Mass. The mine is on the north side of Rocky Rough ravine and near the talc deposits that are also being mined by the Berkshire Talc Manufacturing Company. The asbestos has thus far been found for the most part in pockets containing from 500 to 2,000 pounds each. It has been mined by means of tunnels, and a shaft has been sunk to a depth of 80 feet. There is another outcrop of the asbestos about 3,000 feet farther west, and also one about 1½ miles north, but no work has thus far been done to develop them.

Chrysotile asbestos has also been reported to have been found in the upper Applegate district in the vicinity of Grants Pass, Oreg., near the Oregon-California boundary; and also in the Enchanted Lake region, California, some distance west of Sims Station and near the line between Trinity and Shaster counties. It has been found also near North Wilkesboro, N. C., on the land of Mr. J. B. Church, and this is the most promising deposit in the State.

USES.

New and varied uses are constantly being devised for asbestos. Where it is used as an ingredient in fireproof paints for wall plaster, as boiler coverings, as packing in the manufacture of fireproof safes, and for nearly all purposes in which nonconductivity of heat and not strength of fiber is the important factor, the amphibole variety can be used. On the other hand, where strength of fiber is an essential quality as well as nonconductivity of heat, it is the chrysotile variety that is used, as in the manufacture of cloth, rope, felt, boards, tubes, washers, blocks of various shapes, etc.

In the periodical Stone, for February, 1901, there was described a test, made by the British Fire Prevention Committee, of the fireproof material called gypsine. This material is composed of plastic hydraulic lime, sand, and asbestos compressed into bricks. In testing its fire-resisting properties, a partition 10 feet long by 7 feet, 9 inches wide was built of gypsine bricks laid in hydraulic mortar, with joints a quarter of an inch thick. The side of this partition, which was erected in the test hut, after having been coated with a thin layer of fire clay, was exposed for the space of one hour to a heat which arose during that time to 2050° F. This high temperature had no effect on the gypsine bricks, and throughout the test the temperature of the outer surface of the partition was never sufficiently high to cause the ignition of a match.

PRODUCTION.

The production of asbestos in the United States during 1901 was confined to the mines at Sall Mountain, White County, Ga., with a little from Riverside County, Cal., and from Berkshire County, Mass. It amounted to 747 short tons, valued at $13,498, as compared with 1,054 tons, valued at $16,310, in 1900, and 681 tons, valued at $11,740, in 1899. The annual production of asbestos in the United States and its value since 1880 are given in the following table:

Annual product of asbestos since 1880.

Year.	Quantity.	Value.	Year.	Quantity.	Value.
	Short tons.			*Short tons.*	
1880	150	$4,312	1891	66	$3,960
1881	200	7,000	1892	104	6,416
1882	1,200	36,000	1893	50	2,500
1883	1,000	30,000	1894	325	4,463
1884	1,000	30,000	1895	795	13,525
1885	300	9,000	1896	504	6,100
1886	200	6,000	1897	580	6,450
1887	150	4,500	1898	605	10,300
1888	100	3,000	1899	681	11,740
1889	30	1,800	1900	1,054	16,310
1890	71	4,560	1901	747	13,498

If the figures of this table are compared with those of the following table, which gives the value of the imports of asbestos, it will be seen how very small is the home production and how much room there is for the development of asbestos mining in this country. This discrepancy will be at least lessened by the production of the Vermont and possibly of the Wyoming mines during 1902. At the end of 1902 it is very probable that there will be a considerable difference in the ratio of the domestic production to the imports of asbestos as compared with that of 1901.

IMPORTS.

The value of asbestos imported since 1869 is given in the following table:

Value of asbestos imported since 1869.

Year ending—	Unmanufactured.	Manufactured.	Total.	Year ending—	Unmanufactured.	Manufactured.	Total.
June 30—				Dec. 31—			
1869		$310	$310	1885	$73,026	$617	$73,643
1870		7	7	1886	134,193	932	135,125
1871		12	12	1887	140,264	581	140,845
1872				1888	168,584	8,126	176,710
1873	$18		18	1889	254,239	9,154	263,393
1874	152		152	1890	252,557	5,342	257,899
1875	4,706	1,077	5,783	1891	353,589	4,872	358,461
1876	5,485	396	5,881	1892	262,433	7,209	269,642
1877	1,671	1,550	3,221	1893	175,602	9,403	185,005
1878	3,536	372	3,908	1894	240,029	15,989	256,018
1879	3,204	4,624	7,828	1895	225,147	19,731	244,878
1880	9,736		9,736	1896	229,084	5,773	234,857
1881	27,717	69	27,786	1897	263,640	4,624	268,264
1882	15,235	504	15,739	1898	287,636	12,897	300,533
1883	24,369	243	24,612	1899	303,119	8,949	312,068
1884	48,755	1,185	49,940	1900	331,796	24,155	355,951
				1901	667,087	24,741	691,828

The value of the imports for 1901, amounting to $691,828, is nearly double the value of those for 1900, which amounted to $355,951, and illustrates the increasing demand that there is for asbestos in the United States and the opportunity offered for the working of deposits of this mineral.

CANADIAN PRODUCTION.

As such a large proportion of the asbestos used in the United States is obtained from Canada, the following table, which gives the production of asbestos in that country, will be of interest:

Annual product of asbestos in Canada since 1879.

Year.	Quantity.	Value.	Year.	Quantity.	Value.
	Short tons.			*Short tons.*	
1879	300	$19,500	1891	9,279	$999,978
1880	380	24,700	1892	6,042	388,462
1881	540	35,100	1893	6,473	313,806
1882	810	52,650	1894	7,630	420,825
1883	955	68,750	1895	8,756	368,175
1884	1,141	75,079	1896	12,250	429,856
1885	2,440	142,441	1897	[a]30,442	445,368
1886	3,458	206,251	1898	[a]23,785	486,227
1887	4,619	226,976	1899	[a]25,536	485,849
1888	4,404	255,007	1900	[a]30,641	763,431
1889	6,113	426,554	1901	[a]38,079	1,186,434
1890	9,860	1,260,240			

[a] Including asbestic.

As is seen in this table, there is considerable variation in the average value per ton of the asbestos produced. This is due to the large amounts of asbestic and of low-grade fiber that are included in the total production. The increase of less than 4 per cent in value accompanying an increase of nearly 150 per cent in production in 1897 was due to this fact; and, conversely, the increase of 9.17 per cent in value of 1898, with a decrease of nearly 22 per cent in production, was due to a smaller production of the asbestic. The large increase in value of the production of 1900 was due partially to the temporary shutting down of one of the larger mines, which caused the price of asbestos at once to rise, as the demand was greater than the supply. To this fact also is due the large increase in production of 1901, and a corresponding increase in value.

GRAPHITE.

By Joseph Struthers.

PRODUCTION.

The production of crystalline graphite in the United States during 1901 was 3,967,612 pounds, valued at $135,914, as compared with the reported production of 5,507,855 pounds, valued at $178,761, in 1900. As in previous years, the greater part of this product was derived from the mines at Ticonderoga, N. Y., although the mines in Chester County, Pa., produced a considerable quantity. The mine in Clay County, Ala., which was inoperative during 1900, produced approximately 150 tons of graphite during 1901.

The production of amorphous graphite in 1901 was 809 short tons, valued at $31,800. Under this head is included the so-called graphitic anthracite of Rhode Island, which is of a structure between scaly and granular, and contains in selected samples as much as 52 per cent carbon; and also the so-called Baraga graphite of Michigan, which in reality is a carbonaceous schist. In addition to this production there has been considerable activity in developing graphite mines in Georgia, Montana, Dakota, and New Jersey. In the aggregate some 2,500 tons of material have been mined and are awaiting the selection of proper concentrating processes.

In the following table, which shows the annual production of graphite from 1880 to 1901, inclusive, the refined product is given in pounds, and that used as mined is given in tons.

Production of natural graphite from 1880 to 1901, inclusive.

Year.	Quantity.	Value.
1880 ....pounds..	622,500	$49,800
1881 ....do....	400,000	30,000
1882 ....do....	425,000	34,000
1883 ....do....	575,000	46,000
1884 ....do....	500,000	35,000
1885 ....do....	327,883	26,231
1886 ....do....	415,525	33,242
1887 ....do....	416,000	34,000
1888 ....do....	400,000	33,000
1889	....	72,662
1890	....	77,500
1891 ....pounds..	1,559,674	110,000
1892 ....do....	1,398,365	87,902
1893 ....do....	843,103	63,232
1894 ....do....	918,000	64,010
1895 ....pounds.....	644,700	$52,582
short tons..	2,793	
1896 ....pounds.....	535,858	48,460
short tons..	760	
1897 ....pounds.....	1,361,706	65,730
short tons..	1,070	
1898 ....pounds.....	2,360,000	75,200
short tons..	890	
1899 ....pounds.....	2,900,732	167,106
short tons..	2,324	
1900 ....pounds.....	5,507,855	197,579
short tons..	611	
1901 ....pounds.....	3,967,612	167,714
short tons..	809	

IMPORTS.

The following table gives the amounts of graphite imported into the United States from 1867 to 1901, from which it may be seen that the annual consumption of graphite in recent years far exceeds the domestic production. In 1901 the production of refined or crystalline graphite in the United States equaled 1,771 long tons, which is but little more than one-tenth of the total consumption for that year. The greater part of the import of the higher grade or crystalline graphite is derived from the mines of Ceylon.

Graphite imported into the United States from 1867 to 1901, inclusive.

Year ending—	Unmanufactured.		Manufactured.	Total value.
	Quantity.	Value.	Value.	
June 30—	*Long tons.*			
1867	1,356	$54,131	....	$54,131
1868	3,431	149,083	....	149,083
1869	3,742	351,004	....	351,004
1870	4,040	269,291	$833	270,124
1871	2,581	136,200	3,754	139,954
1872	4,819	329,030	....	329,030
1873	7,877	548,613	....	548,613
1874	5,600	382,591	....	382,591
1875	2,329	122,050	....	122,050
1876	2,530	150,709	17,605	168,314
1877	3,768	204,630	18,091	222,721
1878	3,012	154,757	16,909	171,666
1879	3,283	164,013	24,637	188,650
1880	5,495	278,022	22,941	300,963
1881	7,546	381,966	31,674	413,640
1882	7,521	363,835	25,536	389,371
1883	7,745	361,949	21,721	383,670
1884	7,204	286,393	1,863	288,256
1885	5,523	207,228	....	207,228
1886	4,168	164,111	....	164,111
1887	8,442	331,621	....	331,621
December 31—				
1888	9,200	353,990	....	353,990
1889	8,869	378,057	....	378,057
1890	12,798	594,746	....	594,746
1891	10,118	555,080	....	555,080
1892	11,677	667,775	....	667,775
1893	14,437	865,379	....	865,379
1894	5,814	225,720	....	225,720
1895	8,814	260,090	....	260,090
1896	15,230	437,159	....	437,159
1897	8,533	270,952	....	270,952
1898	13,482	743,820	....	743,820
1899	20,793	1,990,649	....	1,990,649
1900	14,417	1,390,141	....	1,390,141
1901	14,320	895,375	....	895,375

CANADIAN PRODUCTION.

The production of graphite in Canada during 1901 amounted to 2,190 short tons, valued at $44,380, the output being derived mainly from the Brougham mines in Renfrew County, Ontario. The following companies are interested in graphite mining, although some made no production during the year:

Mines in New Brunswick.—Canada Paint Company, near Fairville Station.

Mines in Quebec.—Keystone Graphite Company, Grenville; Walker Mining Company, Buckingham; North American Graphite Company, Buckingham; Buckingham Company, Buckingham; Calumet Graphite Company, Calumet.

Mines in Ontario.—Ontario Graphite Company, Brougham, Ontario.

In the subjoined table are given the amount and value of the production of graphite in Canada from 1886 to 1901.

Annual production of graphite in Canada from 1886 to 1901, inclusive.

Calendar year.	Quantity.	Value.	Calendar year.	Quantity.	Value.
	Short tons.			*Short tons.*	
1886	500	$4,000	1894	3	$223
1887	300	2,400	1895	220	6,150
1888	150	1,200	1896	139	9,455
1889	242	3,160	1897	436	16,240
1890	175	5,200	1898	([a])	13,698
1891	260	1,560	1899	1,130	24,179
1892	167	3,763	1900	1,922	30,940
1893	None.	None.	1901	2,190	44,380

[a] Quantity not reported.

ARTIFICIAL GRAPHITE.

The manufacture of artificial graphite has assumed a very prominent position in the graphite industry, the production during 1901 amounting to 2,500,000 pounds, as compared with 860,750 pounds in 1900.

The manufacture of artificial graphite, both of the crystalline and of the amorphous variety, has been steadily developed by the sole producer, the International Acheson Graphite Company, at Niagara Falls, N. Y., whose progress is shown in the subjoined table of annual production from the commercial inception of the industry in 1897 to 1901. More than one-half of the output for 1901 was in the form of graphitized electrodes for use in the manufacture of alkali and bleach by electrolytic processes, the remainder being consumed in the manufacture of paints, lubricants, pencils, motor brushes, crucibles, and dry batteries. The decrease in unit value of the total production from

8 cents per pound in 1899 and 1900 to 4.75 cents per pound in 1901 was largely due to the increased proportion of the amorphous variety produced.

Production and value of artificial graphite from 1897 to 1901, inclusive.

Year.	Quantity.	Value.	Unit value per pound.
	Pounds.		*Cents.*
1897	162,382	$10,149	6.20
1898	185,647	11,603	6.20
1899	405,870	32,475	8.00
1900	860,750	68,860	8.00
1901	2,500,000	119,000	4.75

WORLD'S PRODUCTION.

In the following table is shown the world's production of graphite, by countries, from 1896 to 1900, inclusive:

World's production of graphite from 1896 to 1900, inclusive.

[Metric tons.]

Country.	1896.		1897.		1898.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
United States	933	$48,460	1,589	$65,730	1,878	$75,200
Austria	35,972	410,081	38,504	439,610	33,062	421,058
Canada	126	9,455	396	16,240	....	13,698
Ceylon	10,463	414,405	19,275	1,159,885	78,509	9,243,263
Germany	5,248	72,108	3,861	66,126	4,593	97,916
India	....	....	61	316	22	110
Italy	3,148	10,193	5,650	11,300	6,435	17,423
Japan	215	6,925	204	16,075	346	10,265
Mexico	620	5,287	907	8,663	1,857	18,237
Sweden	14	491	99	3,240	50	1,620
Total	56,739	977,405	70,546	1,787,185	126,752	9,898,790

Country.	1899.		1900.	
	Quantity.	Value.	Quantity.	Value.
United States	3,774	$167,106	3,054	$197,579
Austria	31,819	395,280	33,663	418,126
Canada	1,025	24,179	1,744	30,940
Ceylon	29,037	2,904,970	([a])	([a])
Germany	5,196	120,250	9,248	136,500
India	1,548	7,572	1,858	9,104
Italy	9,990	55,944	9,720	55,720
Japan	53	5,120	94	9,118
Mexico	2,305	22,847	2,561	25,650
Sweden	[b] 535	1,674	84	3,186
Total	85,282	3,704,942	[c] 91,063	[c] 3,790,893

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[a] Statistics not available. [b] Includes crude. [c] Latest available figures used in making up total.

MINERAL PAINTS.

By JOSEPH STRUTHERS.

MINERALS USED AS PIGMENTS.

The mineral substances included under this heading are those which are mined and prepared primarily for pigments. They consist of iron ores (red and brown hematites) which are ground and used in the manufacture of metallic paint and which are not included in the production of iron ores for the manufacture of metallic iron, clay and other earths containing iron used in making yellow and brown pigments (such as ocher, umber, sienna, etc.), barytes (or "heavy spar") used as a substitute for or as an adulterant of white lead, slate (or shale), soapstone, asbestos, and graphite.

PRODUCTION.

The pigments treated in this report as natural mineral paints consist essentially of metallic paint (including mortar colors), ocher, umber, sienna, venetian red, zinc white, slate, and graphitic and carbonaceous shales ground especially for paint.

The aggregate production of these pigments in 1901 amounted to 107,960 short tons, a decrease of 13,102 short tons as compared with 121,062 short tons in 1900. The value of the product decreased from $4,548,573 in 1900 to $4,509,962 in 1901, almost exactly what it was in 1899. The proportion of decrease was most apparent in the production of metallic paint, venetian red, and to a lesser extent, zinc white. The production of metallic paint in 1901 showed a marked decrease from that in 1900, being respectively 15,915 short tons and 23,218 short tons. The production of mortar colors increased 2,657 short tons in quantity and $33,032 in value. The production of ocher decreased from 17,015 short tons, valued at $186,707, in 1900 to 16,711 short tons, valued at $177,799, in 1901. The output of venetian red decreased from 14,696 short tons in 1900 to 9,201 short tons in 1901, and the value decreased from $236,574 to $153,467.

In considering the variations between product and value per ton allowance must be made for the comparatively wide range in the qualities of the materials, and for the fact that a larger production of a higher or lower priced article will effect a comparatively larger or smaller increase in the value, as the case may be, so that the rise or fall shown in the average price may be apparent only. Zinc white and venetian red are practically uniform in quality, but this does not hold true with the other pigments. It is evident that the decline in value of metallic paint to $10.67 per short ton in 1899, notwithstanding an increased tonnage, was due to the displacement in the market of some higher-priced paint by a cheaper article. In 1900, however, the price rose to $11.27 and in 1901 to $12.87 per short ton.

The production of mineral paints during the last eight years is shown in the following table:

Production of mineral paints from 1894 to 1901, inclusive.

Kind.	1894.		1895.		1896.		1897.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Short tons.		*Short tons.*		*Short tons.*		*Short tons.*	
Ocher	9,768	$96,935	12,045	$139,328	14,074	$136,458	14,006	$162,764
Umber	265	3,830	320	4,350	165	2,646	[a] 1,080	11,710
Sienna	160	3,250	275	6,950	395	5,416	620	10,610
Metallic paint	15,225	189,922	17,315	212,761	14,805	180,131	16,699	187,694
Mortar color	10,150	94,961	11,544	106,381	9,660	89,600	8,237	75,570
Venetian red	2,983	73,300	4,595	102,900	4,138	93,866	13,603	294,744
Zinc white	19,987	1,399,090	20,710	1,449,700	20,000	1,400,000	25,000	1,750,000
Soapstone	75	525	270	3,200	....	....	2	20
Slate [b]	3,300	35,370	4,331	45,682	4,795	44,835	4,666	46,681
Other colors	....	....	....	....	....	....	2,000	6,000
Total	61,913	1,897,183	71,405	2,071,252	68,032	1,952,955	85,913	2,545,793

Kind.	1898.		1899.		1900.		1901.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Short tons.		*Short tons.*		*Short tons.*		*Short tons.*	
Ocher	11,963	$123,832	14,124	$140,168	17,015	$186,707	16,711	$177,799
Umber	[c] 1,177	8,285	473	4,151	1,452	26,927	759	11,326
Sienna	689	11,140	588	8,205	957	14,771	305	9,304
Metallic paint	20,972	263,979	23,423	249,945	23,218	261,831	15,915	204,937
Mortar color	7,107	74,894	5,736	65,156	6,689	79,911	9,346	112,943
Venetian red	10,271	160,711	11,991	210,361	14,696	236,574	9,201	153,467
Zinc white	33,000	2,310,000	40,146	3,211,680	48,840	3,667,210	46,500	3,720,000
Soapstone	100	800	100	700	100	700	50	350
Slate [b]	4,571	46,215	4,676	43,703	6,395	53,942	4,865	41,211
Other colors	2,000	6,000	2,000	6,000	1,700	20,000	4,308	78,625
Total	91,850	3,005,856	103,257	3,940,069	121,062	4,548,573	107,960	4,509,962

[a] Includes 600 tons of Spanish brown.

[b] Includes mineral black.

[c] Includes 640 tons of Spanish brown.

OCHER, UMBER, AND SIENNA.

PRODUCTION.

The production of ocher in the United States during 1901 was slightly smaller than in the preceding year, being 16,711 short tons, valued at $177,799, as compared with 17,015 short tons, valued at $186,707, in 1900. Nine States contributed to the output: Arkansas, Illinois, Iowa, Virginia, Wisconsin, California, Georgia, Pennsylvania, and Vermont. Alabama and Massachusetts, which reported a production in 1900, were numbered in the list of nonproducing States in 1901. In only four of these States—California, Georgia, Pennsylvania, and Vermont—were there more than two producers, and the outputs of the other producing States are grouped together in order not to reveal private and confidential information.

Pennsylvania produced 45 per cent of the total output of ocher in 1900 and 46 per cent in 1901. The production of Georgia was over 25 per cent smaller in quantity and 33 per cent less in value than that of the preceding year, being 5,077 short tons, valued at $49,176, as compared with 6,828 short tons, valued at $73,172, in 1900.

Pennsylvania contributed 7,632 short tons of ocher, valued at $76,106, during 1901, as compared with 7,601 short tons, valued at $84,661, in 1900, a slight increase in quantity but a decided decrease in value.

The production of Vermont decreased from 401 short tons, valued at $3,856, in 1900 to 370 short tons, valued at $3,493, in 1901.

Umber was produced by four States during 1901—Illinois, Pennsylvania, Georgia, and New York—the two latter being new producers; and sienna was reported from three States—Illinois, Pennsylvania, and New York.

The following tables show the production of ocher during the last four years, by States, and the total production of ocher, umber, and sienna since 1896. The variations in value are in many cases due chiefly to an increased or decreased production of different grades of these pigments and not to any notable fluctuations in prices.

Production of ocher in 1898, 1899, 1900, and 1901, by States.

State.	1898.		1899.		1900.		1901.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Short tons.		*Short tons.*		*Short tons.*		*Short tons.*	
Georgia	2,858	$30,798	3,212	$39,505	6,828	$73,172	5,077	$49,176
Pennsylvania	5,986	61,500	7,285	57,245	7,601	84,661	7,632	76,106
Vermont	664	6,650	653	6,200	401	3,856	370	3,493
Other States	2,455	24,884	2,974	37,218	2,185	25,018	3,632	49,024
Total	11,963	123,832	14,124	140,168	17,015	186,707	16,711	177,799

Production of ocher, umber, and sienna from 1896 to 1901, inclusive.

Year.	Ocher.		Umber.		Sienna.		Total.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Short tons.		*Short tons.*		*Short tons.*		*Short tons.*	
1896	14,074	$136,458	165	$2,646	395	$5,416	14,634	$144,520
1897	14,006	162,764	[a]1,080	11,710	620	10,610	15,706	185,084
1898	11,963	123,832	[b]1,177	8,285	689	11,140	13,829	143,257
1899	14,124	140,168	473	4,151	588	8,205	15,185	152,524
1900	17,015	186,707	1,452	26,927	957	14,771	19,424	228,405
1901	16,711	177,799	759	11,326	305	9,304	17,775	198,429

[a] Includes 600 tons Spanish brown from Maryland. [b] Includes 640 tons Spanish brown from Maryland.

The combined annual production of ocher, umber, and sienna for the years 1884 to 1895, inclusive, is shown in the following table:

Production of ocher, umber, and sienna from 1884 to 1895, inclusive.

Year.	Quantity.	Value.	Year.	Quantity.	Value.
	Short tons.			*Short tons.*	
1884	7,000	$84,000	1890	17,555	$237,523
1885	3,950	43,575	1891	18,294	233,823
1886	6,300	91,850	1892	14,365	193,074
1887	8,000	75,000	1893	11,147	141,828
1888	10,000	120,000	1894	10,193	104,015
1889	15,158	177,472	1895	12,640	150,628

IMPORTS.

The following tables show the amount and value of ochers, etc., imported into the United States from 1867 to 1901:

Ocher, etc., imported from 1867 to 1883.

Fiscal year ending June 30—	All ground in oil.		Indian red and Spanish brown.		Mineral French and paris green.		Other, dry, not otherwise specified.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Pounds.		*Pounds.*		*Pounds.*		*Pounds.*	
1867	11,373	$385	....	$35,374	....	$2,083	1,430,118	$9,923
1868	6,949	333	....	11,165	....	500	3,670,093	32,102
1869	65,344	2,496	2,582,335	31,624	8,369	2,495	5,379,478	39,546
1870	149,240	6,042	3,377,944	41,607	9,618	3,444	3,935,978	32,593
1871	121,080	4,465	2,286,930	40,663	33,488	11,038	2,800,148	24,767
1872	277,617	9,225	2,810,282	38,763	41,422	10,341	5,645,343	56,680
1873	94,245	3,850	135,360	2,506	34,382	8,078	3,940,785	51,318
1874	98,176	4,623	263,389	3,772	102,876	18,153	3,212,988	35,365
1875	280,517	12,352	646,009	9,714	64,910	13,506	3,282,415	37,929
1876	63,916	3,365	2,524,989	19,555	21,222	5,385	3,962,646	47,405
1877	41,718	2,269	2,179,631	24,218	27,687	6,724	3,427,208	32,924
1878	25,674	1,591	2,314,028	23,677	67,655	14,376	3,910,947	33,260
1879	17,649	1,141	2,873,550	26,929	17,598	3,114	3,792,850	42,563
1880	91,293	4,233	3,655,920	32,726	16,154	3,269	4,602,546	52,120
1881	99,431	4,676	3,201,880	30,195	75,465	14,648	3,414,704	46,069
1882	159,281	7,915	3,789,586	34,136	18,293	2,821	5,530,204	68,106
1883[a]	137,978	6,143	1,549,968	13,788	6,972	885	7,022,615	90,593

[a] Since 1883 classified as "dry" and "ground in oil."

Imports of ocher of all kinds from 1884 to 1901, inclusive.

Year ending—	Dry.		Ground in oil.		Total.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
June 30—	*Pounds.*		*Pounds.*		*Pounds.*	
1884	6,164,359	$63,973	108,966	$4,717	6,273,325	$68,690
1885	4,983,701	51,499	79,666	3,616	5,063,367	55,115
Dec. 31—						
1886	4,939,183	53,593	112,784	6,574	5,051,967	60,167
1887	5,957,200	58,162	54,104	7,337	6,011,304	65,499
1888	6,574,608	64,123	43,142	9,690	6,617,750	73,813
1889	5,540,267	52,502	51,063	9,072	5,591,330	61,574
1890	....	....	....	....	6,471,863	71,953
1891	6,246,890	63,040	52,206	5,272	6,299,096	68,312
1892	8,044,836	97,946	49,714	5,120	8,094,550	103,066
1893	6,225,789	55,074	52,468	3,354	6,278,257	58,428
1894	4,937,738	45,276	22,387	2,100	4,960,125	47,376
1895	7,107,987	56,020	41,153	2,239	7,149,140	58,259
1896	8,954,252	68,196	27,023	1,561	8,981,275	69,757
1897	[a]7,720,075	59,272	20,123	1,000	7,740,198	60,272
1898	5,898,725	46,571	31,460	1,546	5,930,185	48,117
1899	9,765,616	72,825	14,881	756	9,780,497	73,581
1900	8,449,252	57,342	19,167	1,019	8,468,419	58,361
1901	8,546,691	83,196	16,738	918	8,563,429	84,114

[a] Since 1896 classified as "dry—crude and powdered, washed or pulverized."

Imports of umber from 1867 to 1901, inclusive.

Year ending—	Quantity.	Value.	Year ending—	Quantity.	Value.
June 30—	*Pounds.*		June 30—	*Pounds.*	
1867	2,147,342	$15,946	1885	1,198,000	$8,504
1868	345,173	2,750	Dec. 31—		
1869	570,771	6,159	1886	1,262,930	9,187
1870	708,825	6,313	1887	2,385,281	16,536
1871	470,392	7,064	1888	1,423,800	14,684
1872	1,409,822	18,203	1889	1,555,070	20,887
1873	845,601	8,414	1890	1,556,823	19,329
1874	729,864	6,200	1891	633,291	6,498
1875	513,811	5,596	1892	1,028,038	6,256
1876	681,199	7,527	1893	1,488,849	16,636
1877	1,101,422	10,213	1894	632,995	6,275
1878	1,038,880	8,302	1895	[a]1,560,786	13,075
1879	986,105	6,959	1896	[b]689,075	8,360
1880	1,877,645	17,271	1897	[c]1,447,889	14,479
1881	1,475,835	11,126	1898	[d]1,123,079	9,051
1882	1,923,648	20,494	1899	[e]1,739,036	13,326
1883	785,794	8,419	1900	[f]1,703,256	11,862
1884	2,946,675	20,654	1901	[g]1,465,431	12,510

[a] Includes 6,137 pounds "ground in oil" and 1,554,649 pounds "dry."

[b] Includes 5,292 pounds "ground in oil" and 683,783 pounds "dry."

[c] Includes 14,471 pounds "ground in oil" and 1,433,418 pounds "dry—crude or powdered."

[d] Includes 4,608 pounds "ground in oil" and 1,118,471 pounds "dry—crude and powdered, washed or pulverized."

[e] Includes 4,849 pounds "ground in oil" and 1,734,187 pounds "dry—crude and powdered, washed or pulverized."

[f] Includes 11,653 pounds "ground in oil" and 1,691,603 pounds "dry—crude and powdered, washed or pulverized."

[g] Includes 3,181 pounds "ground in oil" and 1,462,247 pounds "dry—crude and powdered, washed or pulverized."

Imports of sienna from 1893 to 1901, inclusive.

Year ending Dec. 31—	Dry.		Ground in oil.		Year ending Dec. 31—	Dry.		Ground in oil.	
	Quantity.	Value.	Quantity.	Value.		Quantity.	Value.	Quantity.	Value.
	Pounds.		*Pounds.*			*Pounds.*		*Pounds.*	
1893........	1,626,536	$138,889	5,857	$610	1898.......	544,713	$11,451	4,008	$280
1894........	337,909	9,424	18,877	895	1899.......	798,691	14,470	6,484	492
1895........	456,861	11,021	6,576	501	1900.......	796,534	14,912	6,335	495
1896........	668,461	10,857	10,848	877	1901.......	1,106,553	18,294	13,861	1,004
1897........	580,468	12,340	7,058	481					

PRODUCTION OF OCHER IN PRINCIPAL PRODUCING COUNTRIES.

The following table gives the output of ocher in the principal producing countries of the world as far as statistics are available. France leads in quantity, with Great Britain second, and the United States third. The production in France has each year amounted to more than that of the United States and Great Britain combined, although the value of the French product, except for 1897 and 1900, was but little more than that of the United States, and in these years it was considerably less. The German Empire stands fourth, with a production of about 33 per cent of that of France during 1900, although the value was less than 16 per cent.

Production of ocher in principal producing countries from 1893 to 1901.

Year.	United States.		United Kingdom.		France.		German Empire.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Short tons.		*Short tons.*		*Short tons.*		*Short tons.*	
1893................	11,147	$141,828	11,798	$67,318	....	....	....	....
1894................	10,193	104,015	9,538	68,094	....	....	....	....
1895................	12,640	150,628	8,540	82,397	36,456	$142,756	9,911	$25,297
1896................	14,634	144,520	11,078	99,737	30,304	125,164	9,918	26,227
1897................	15,706	185,084	16,153	63,165	35,594	150,714	9,660	25,242
1898................	13,829	143,257	22,206	63,065	37,236	152,002	9,642	31,737
1899................	14,124	140,168	18,272	66,082	36,090	155,821	10,234	31,750
1900................	17,015	186,707	17,024	61,627	36,454	164,000	12,681	25,078
1901................	16,711	177,799	16,287	....	....	....	....	....

Year.	Canada.		Belgium.		Spain.		Cyprus.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Short tons.		*Short tons.*		*Short tons.*		*Short tons.*	
1893................	1,070	$17,710	1,408	$1,351	1,135	$685	....	....
1894................	611	8,690	400	965	132	232	1,714	$3,822
1895................	1,339	14,600	800	1,930	224	760	1,500	3,293
1896................	2,362	16,045	1,120	2,702	234	820	3,240	6,955
1897................	3,905	23,560	560	1,400	220	772	1,721	3,776
1898................	2,340	18,531	320	1,138	220	800	3,206	4,656
1899................	3,919	19,900	330	1,158	110	400	1,098	2,443
1900................	1,966	15,398	330	1,158	64	232	....	....
1901................	2,233	16,735	....	....	....	....	....	....

METALLIC PAINT.

Metallic paint is manufactured by grinding certain kinds of hematite iron ore. In some cases the ores are roasted before grinding, in order to improve the color and durability. Considering the widespread occurrence and the enormous deposits of iron ore existing in the United States, the quantity of material suitable for making a good metallic paint is very small and the localities are comparatively rare. Among the localities from which good paint ore is to be obtained are Oneida, Rensselaer, Cattaraugus, and Washington counties, N. Y.; Lehigh, Carbon, and Mercer counties, Pa.; Hamilton and James counties, Tenn.; and Dodge County, Wis. It is also produced in smaller quantities in Maryland, Arkansas, California, Illinois, Iowa, Vermont, Missouri, Ohio, and Wyoming. Part of the ore ground for paint is used as a coloring matter in mortar making. It is not always possible to separate exactly the quantity used for mortar colors; the manufacturers, having sold it as dry ground paint, do not always know the purpose for which it is consumed after leaving their hands. The separation given in this report is the best that could be made under these circumstances, but it is not claimed to be absolutely correct.

The production of metallic paint in 1901, exclusive of mortar colors, was 15,915 short tons, as against 23,218 short tons in 1900—a remarkable decrease of 7,303 tons, or over 31 per cent. The value decreased from $261,831 in 1900 to $204,737 in 1901. On the other hand, the production of mortar colors increased from 6,689 short tons, valued at $79,911, in 1900 to 9,346 short tons, valued at $112,943, in 1901, an increase of 2,657 short tons in amount, or nearly 40 per cent, and of $33,032 in value.

The statistics of production in 1900 and 1901 are given in the following table:

Production of metallic paint and mortar colors in 1900 and 1901.

State.	1900.				1901.			
	Metallic paint.		Mortar colors.		Metallic paint.		Mortar colors.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Short tons.		*Short tons.*		*Short tons.*		*Short tons.*	
New York	2,550	$26,900	2,350	$25,050	2,065	$25,150	3,300	$45,000
Pennsylvania	11,376	152,310	1,160	17,220	8,422	120,298	2,150	22,400
Tennessee	....	....	....	....	3,100	27,350	1,500	15,000
Other States	9,292	82,621	3,179	37,641	2,328	31,939	2,396	30,543
Total	23,218	261,831	6,689	79,911	15,915	204,737	9,346	112,943

The annual product of metallic paint and mortar colors for the last thirteen years has been as follows:

Production of metallic paint and mortar colors from 1889 to 1901, inclusive.

Year.	Metallic paint.[a]		Mortar colors.		Year.	Metallic paint.[a]		Mortar colors.	
	Short tons.	Value.	Short tons.	Value.		Short tons.	Value.	Short tons.	Value.
1889	21,026	$286,294			1896	14,805	$180,134	9,660	$89,600
1890	24,177	340,369			1897	16,699	187,694	8,237	75,570
1891	25,142	334,455			1898	20,972	263,979	7,107	74,894
1892	25,711	362,966			1899	23,423	249,945	5,736	65,156
1893	19,960	297,289			1900	23,218	261,831	6,689	79,911
1894	15,225	189,922	10,150	$94,961	1901	15,915	204,737	9,346	112,943
1895	17,315	212,761	11,544	106,381					

[a] Includes mortar colors from 1889 to 1893, inclusive.

VENETIAN RED.

Venetian red is a bright-red pigment, which is obtained by submitting iron sulphate (commonly called "copperas" or "green vitriol") to a roasting process, whereby the sulphur is oxidized by heat and driven off as sulphur dioxide, leaving the iron oxide of a brighter red than the natural product. The quantity of iron oxide so consumed is small in comparison with the total iron oxide pigment produced, and for this reason the output of venetian red is combined with the output of mineral paints.

The production of venetian red during 1901 was 9,201 short tons, as compared with 14,696 short tons in 1900. Accompanying this decrease in quantity was a decrease in value from $236,574 to $153,467. The annual production since 1890 has been as follows:

Production of venetian red from 1890 to 1901, inclusive.

Year.	Quantity.	Value.	Year.	Quantity.	Value.
	Short tons.			*Short tons.*	
1890	4,000	$84,100	1896	4,138	$93,866
1891	4,191	90,000	1897	13,603	294,744
1892	4,900	106,800	1898	10,271	160,711
1893	3,214	64,400	1899	11,991	210,361
1894	2,983	73,300	1900	14,696	236,574
1895	4,595	102,900	1901	9,201	153,467

SLATE GROUND FOR PIGMENT.

The quantity of slate and shale ground for paint in 1901, including "mineral black," was 4,865 short tons, valued at $41,211, as compared with 6,395 short tons, valued at $53,942, in 1900. This table does not include the so-called "Baraga graphite" of Michigan, which is a carbonaceous shale or schist, nor the graphitic anthracite of Rhode Island, both of which are used to some extent in the manufacture of "graphite paints," the statistics of production and value of which will be found elsewhere in this volume under the caption "Graphite."

The annual production of pigments made from slate and shale since 1880 has been as follows:

Quantity and value of slate and shale ground for pigment from 1880 to 1901, inclusive.

Year.	Quantity.	Value.	Year.	Quantity.	Value.
	Short tons.			*Short tons.*	
1880	1,120	$10,000	1891	2,240	$20,000
1881	1,120	10,000	1892	3,787	23,523
1882	2,240	24,000	1893	3,253	25,567
1883	2,240	24,000	1894	3,300	35,370
1884	2,240	20,000	1895	4,331	45,682
1885	2,212	24,687	1896	4,795	44,835
1886	3,360	30,000	1897	4,666	46,681
1887	2,240	20,000	1898	4,571	46,215
1888	2,800	25,100	1899	4,676	43,703
1889	2,240	20,000	1900[a]	6,395	53,942
1890	2,240	20,000	1901	4,865	41,211

[a] Includes mineral and carbon black.

WHITE LEAD, RED LEAD, LITHARGE, AND ORANGE MINERAL.

PRODUCTION.

The aggregate production of lead pigments during 1901 was slightly greater than for 1900, the increase being distributed among all varieties except litharge, of which a few pounds less were produced.

The production of white lead in oil, which amounted to 170,214,565 pounds in 1899 and 151,874,933 pounds in 1900, was 154,606,670 pounds in 1901. There was an increase in the production of dry white lead from 44,544,971 pounds in 1900 to 46,966,945 pounds in 1901. The quantity of white lead imported during 1901 amounted to 384,673 pounds, which is the smallest recorded amount since 1867. The imports of white lead in 1869, the largest on record in this period, amounted to 8,948,642 pounds.

The production of red lead during 1901 showed a large increase above the returns for the preceding year, being 26,206,096 pounds, as compared with 21,486,825 pounds in 1900. The value also increased from $1,198,008 to $1,448,550 in 1901. The increased production was reflected in the decreased imports which were 549,551 pounds in 1900 and 485,467 pounds in 1901.

The quantity of litharge produced during the past two years has practically remained constant, being 18,984,145 pounds in 1900 and 18,919,036 pounds in 1901. The value of the output decreased from $990,391 in 1900 to $979,586 in 1901. The quantity of litharge imported during 1901 was 49,306 pounds, as compared with 77,314 pounds in 1900, which shows that less of the domestic consumption is being supplied from foreign sources than in former years.

The production of orange mineral increased from 1,973,016 pounds in 1900 to 2,174,727 pounds in 1901, which was accompanied by an increase in value from $149,288 to $224,667. The imports of orange mineral in 1901 were 977,644 pounds, as compared with 1,068,793 pounds in 1900. Of all the lead oxide pigments, orange mineral is the only one of which the quantity imported is sufficiently great to have any marked influence on the domestic consumption. The total quantity of lead oxide imported during 1901 was 12 per cent less than the imports for 1900, and but 2½ per cent of the importation of 1871.

The production of white lead, red lead, litharge, and orange mineral in 1899, 1900, and 1901 was as follows:

Production of white lead, red lead, litharge, and orange mineral during 1899, 1900, and 1901.

	1899.		1900.		1901.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
White lead	*Pounds.*		*Pounds.*		*Pounds.*	
In oil	170,214,565	$8,977,268	151,874,933	$8,430,996	154,606,670	$8,978,441
Dry	50,178,486	2,340,689	44,544,971	2,226,960	46,966,945	2,274,212
Red lead	22,157,694	1,192,927	21,486,825	1,198,008	26,206,096	1,448,550
Litharge	21,937,704	1,159,698	18,984,145	990,391	18,919,036	979,586
Orange mineral	2,024,302	146,720	1,973,016	149,288	2,174,727	224,667

The annual production of white lead since 1884 has been as follows:

Production of white lead in the United States from 1884 to 1901, inclusive.

Year.	Quantity.	Value.	Year.	Quantity.	Value.
	Short tons.			*Short tons.*	
1884	65,000	$6,500,000	1893	72,172	$7,695,130
1885	60,000	6,300,000	1894	76,343	6,623,071
1886	60,000	7,200,000	1895	90,513	8,723,632
1887	70,000	7,560,000	1896	88,608	8,371,588
1888	84,000	10,080,000	1897	95,658	9,676,815
1889	80,000	9,600,000	1898	96,047	9,400,622
1890	77,636	9,382,967	1899	110,197	11,317,957
1891	78,018	10,454,029	1900	98,210	10,657,956
1892	71,485	8,733,620	1901	100.787	11,252,653

IMPORTS.

The following table gives the imports of white lead, red lead, litharge, and orange mineral from 1867 to 1901, inclusive:

White lead, red lead, litharge, and orange mineral imported from 1867 to 1901, inclusive.

Year ending—	White lead.		Red lead.		Litharge.		Orange mineral.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
June 30—	*Pounds.*		*Pounds.*		*Pounds.*		*Pounds.*	
1867	6,636,508	$430,805	926,843	$53,087	230,382	$8,941	....	....
1868	7,533,225	455,698	1,201,144	76,773	250,615	12,225	....	....
1869	8,948,642	515,783	808,686	46,481	187,333	7,767	....	....
1870	6,228,285	365,706	1,042,813	54,626	97,398	4,442	....	....
1871	8,337,842	483,392	1,295,616	78,410	70,889	3,870	....	....
1872	7,153,978	431,477	1,513,794	85,644	66,544	3,396	....	....
1873	6,331,373	408,986	1,583,039	99,891	40,799	2,379	....	....
1874	4,771,509	323,926	756,644	56,305	25,687	1,450	....	....
1875	4,354,131	295,642	1,048,713	73,131	15,767	950	....	....
1876	2,546,776	175,776	749,918	54,884	47,054	2,562	....	....
1877	2,644,184	174,844	387,260	28,747	40,331	2,347	....	....
1878	1,759,608	113,638	170,608	9,364	28,190	1,499	....	....
1879	1,274,196	76,061	143,237	7,237	38,495	1,667	....	....
1880	1,906,931	107,104	217,033	10,397	27,389	1,222	....	....
1881	1,068,030	60,132	212,423	10,009	63,058	2,568	....	....
1882	1,161,889	64,493	288,946	12,207	54,592	2,191	....	....
1883	1,044,478	58,588	249,145	10,503	34,850	1,312	....	....
1884	902,281	67,918	265,693	10,589	54,183	1,797	....	....
1885	705,535	40,437	216,449	7,641	35,283	1,091	....	....
Dec. 31—								
1886	785,554	57,340	597,247	23,038	51,409	1,831	....	....
1887	804,320	58,602	371,299	16,056	35,908	1,302	....	....
1888	627,900	49,903	529,665	23,684	62,211	2,248	....	....
1889	661,694	56,875	522,026	24,400	41,230	1,412	....	....
1890	742,196	57,659	450,402	20,718	48,283	2,146	....	....
1891	718.228	40,773	651,577	23,807	94,586	3,108	....	....
1892	744,838	40,032	812,703	28,443	56,737	1,811	1,409,601	$64,133
1893	686,490	34,145	854,982	27,349	42,582	1,310	1,385,828	61,360
1894	796,480	40,939	947,873	29,064	38,595	1,064	1,386,464	58,614
1895	1,897,892	79,887	1,764,274	53,139	97,667	2,812	1,689,367	66,492
1896	1,183,538	52,409	1,543,262	47,450	51,050	1,615	1,359,651	51,077
1897	1,101,829	48,988	1,386,070	46,992	60,984	1,931	1,486,042	67,549
1898	506,739	24,334	682,449	25,780	56,417	2,021	795,116	37,745
1899	583,409	30,212	776,197	30,479	55,127	3,614	1,141,387	58,142
1900	456,872	28,366	549,551	25,532	77,314	2,852	1,068,793	61,885
1901	384,673	21,226	485,467	19,370	49.306	1,873	977,644	52,409

PRICES.

The following table shows the average yearly market prices of corroding pig lead, the net price of white lead in oil (both at New York), and the difference between the two since 1874:

Average yearly net prices, at New York, of pig lead and white lead in oil from 1874 to 1901, inclusive.

Year.	Pig lead, in New York.	White lead in oil, in New York.	Difference.	Year.	Pig lead, in New York.	White lead in oil, in New York.	Difference.
	Per 100 pounds.	*Per 100 pounds.*	*Per 100 pounds.*		*Per 100 pounds.*	*Per 100 pounds.*	*Per 100 pounds.*
1874	$6.00	$11.25	$5.25	1888	$4.41	$5.75	$1.34
1875	5.95	10.50	4.55	1889	3.80	6.00	2.20
1876	6.05	10.00	3.95	1890	4.33	6.25	1.92
1877	5.43	9.00	3.57	1891	4.33	6.37	2.05
1878	3.58	7.25	3.67	1892	4.05	6.39	2.34
1879	4.18	7.00	2.82	1893	3.73	6.03	2.30
1880	5.05	7.60	2.55	1894	3.28	5.26	1.98
1881	4.80	7.25	2.45	1895	3.28	5.05	1.77
1882	4.90	7.00	2.10	1896	3.03	4.90	1.87
1883	4.32	6.88	2.56	1897	3.64	5.00	1.36
1884	3.73	5.90	2.17	1898	3.79	5.08	1.29
1885	3.95	6.00	2.05	1899	4.53	5.35	.82
1886	4.63	6.25	1.62	1900	4.55	5.57	1.02
1887	4.47	5.75	1.28	1901	4.51	5.87	1.36

It will be observed from the foregoing table that the difference in price between white lead in oil and pig lead in New York in 1901 was $1.36, as compared with a difference of $1.02 in 1900. Against this must be set the difference in the price of linseed oil, which varied from 50 to 82 cents per gallon in 1901, and from 50 to 67 cents per gallon in 1900. The price of linseed oil at the beginning of 1900 was 56 cents per gallon; it sold as low as 50 cents in September, and reached the highest point of the year, 67 cents, in July. Beginning with 56 cents in January of 1901, the price advanced until it reached 82 cents in July, and then declined until 50 cents was reached in September, closing the year at 55 cents. The market price for pig lead in New York opened at 4.52½ cents and closed at 4.12½ cents. The former price was maintained until December 17, when it dropped to 4.12½, and continued at this quotation for the remainder of the year.

The fluctuations in price of linseed oil at New York during the last eight years are shown in the following table:

Price of linseed oil at New York from 1894 to 1901, inclusive.

[In cents per gallon.]

Year.	Highest.	Lowest.	Year.	Highest.	Lowest.
1894	56	50	1898	46	34
1895	59	42	1899	50	37
1896	41	31	1900	67	50
1897	43	30	1901	82	50

ZINC WHITE.

The production of zinc white in the United States during 1901 was slightly less than in the preceding year, being 46,500 short tons, valued at $3,720,000, as compared with 48,840 short tons, valued at $3.677,210, in 1900. Thus while the output was smaller in quantity, its value was greater, due to the higher price which prevailed during 1901. The production of white lead (both dry and in oil) during 1901 showed an increase of 2,577 short tons, above corresponding production for 1900. These figures do not include the so-called "zinc-lead" pigment, the production of which is reported on page 910.

IMPORTS.

The imports of zinc oxide during 1901 were: Dry 3,199,778 pounds, in oil 128,198 pounds, total 3,327,976 pounds, as compared with dry 2,618,808 pounds, in oil 38,706 pounds, total 2,657,514 pounds in 1900, which shows an increase for 1901 of practically 25 per cent above the imports during the preceding year.

The following table gives the production of zinc oxide from 1880 to 1901:

Production of zinc white from 1880 to 1901, inclusive.

Year.	Quantity.	Value.	Year.	Quantity.	Value.
	Short tons.			*Short tons.*	
1880	10,107	$763,738	1891	23,700	$1,600,000
1881	10,000	700,000	1892	27,500	2,200,000
1882	10,000	700,000	1893	24,059	1,804,420
1883	12,000	840,000	1894	19,987	1,399,090
1884	13,000	910,000	1895	20,710	1,449,700
1885	15,000	1,050,000	1896	20,000	1,400,000
1886	18,000	1,440,000	1897	25,000	1,750,000
1887	18,000	1,440,000	1898	33,000	2,310,000
1888	20,000	1,600,000	1899	40,146	3,211,680
1889	16,970	1,357,600	1900	48,840	3,667,210
1890		1,600,000	1901	38,889	3,111,120

The imports of zinc white, both dry and in oil, in 1901 were 670,462 pounds greater than in 1900, which latter year showed the smallest quantity imported since 1888. This shows that the domestic product has displaced a considerable quantity of the foreign material in the home markets. The imports of zinc white of both kinds in 1901, though greater than in 1900, were of less value than the imports in 1899.

The following table shows the quantity of zinc white, dry and in oil, imported into the United States since 1885:

Imports of zinc oxide (dry and in oil) from 1885 to 1901, inclusive.

Year ending—	Dry.	In oil.	Year ending—	Dry.	In oil.	Total value.
	Pounds.	*Pounds.*		*Pounds.*	*Pounds.*	
June 30, 1885	2,233,128	98,566	Dec. 31—			
Dec. 31—			1894	3,371,292	59,291	$122,690
1886	3,536,289	79,788	1895	4,546,049	129,343	153,641
1887	4,961,080	123,216	1896	4,572,781	311,023	161,188
1888	1,401,342	51,985	1897	5,564,763	502,357	206,636
1889	2,686,861	66,240	1898	3,342,235	27,050	130,039
1890	2,631,458	102,298	1899	3,012,709	41,699	172,359
1891	2,839,351	128,140	1900	2,618,808	38,706	142,395
1892	2,442,014	111,190	1901	3,199,778	128,198	166,908
1893	3,900,749	254,807				

ZINC-LEAD.

In addition to the products given in the above table, the United States Reduction and Refining Company, at Canyon, Colo., produced 2,500 short tons of "zinc-lead," valued at $150,000. This pigment is a mixture of the oxidized compounds of zinc and lead, and is made by an oxidizing smelting of lead and zinc ores in a furnace of special design.

BARYTES.

By Joseph Hyde Pratt.

OCCURRENCE.

Barite, or barytes as it is commercially known, a sulphate of barium ($BaSO_4$), is a heavy white mineral with perfect prismatic cleavage, and is found rather widely distributed in nature. In many places it occurs in sufficient quantity to become a source of supply for commercial purposes. Barite does not usually occur in well-defined veins, but is more often found in a series of pockets or lenses of varying dimensions. These are more or less in line, often following the dip of the rock with which they are associated, and this in many cases is a limestone. Galena, a sulphide of lead, is a commonly associated mineral of barytes.

In the United States this mineral has been found in quantity in Connecticut, Virginia, North Carolina, Tennessee, and Missouri, and all but the first-named State were producers of it during the last few years. None of these barytes deposits are worked to any great depth, because of the cost of deep mining as compared with the low price that is obtained for it. Many of the deposits are worked by open cuts and others by means of shafts and drifts.

Virginia.—The Virginia barite mines are in Bedford, Pittsylvania, Campbell, and Tazewell counties, centering, for the most part, around Evington, Campbell County, and Richlands, Tazewell County. At Evington the Hewitt mines have been worked almost continuously since 1874. The barite occurs in a series of lenticular pockets which have a general northeast-southwest strike and dip from 20° to 30° toward the east. The general width of this series of pockets is from 100 to 200 or more feet, and in length they occur for about 4 miles. At times these pockets are entirely distinct from each other, and again they are connected by a thin seam of barite. The foot-wall of the

Hewitt barite is usually limestone, and some of the pockets were found entirely inclosed by limestone. The barite was encountered near the surface, and has been worked to a depth of 150 feet in one place. It is shipped to Lynchburg, Va., where it is cleaned and ground. Three miles southwest of the Hewitt mine is the Mattocks, which is a mile southwest of Otter River, a station on the Southern Railroad. Although barite of good quality and in quantity is found here, it has not been mined in recent years on account of water, which makes the mining too expensive. Three miles northeast of the Hewitt mine barite is being mined on Troublesome Creek. A few miles north-northwest of Catletts, Fauquier County, barite was mined extensively thirty years ago, but is now being obtained in only small amount. In the vicinity of Richlands, Tazewell County, the Tri-State Mining and Manufacturing Company has purchased a large tract of land containing barytes deposits. The company is fitting the property with machinery for mining, and is erecting a plant of 50 tons capacity for grinding the mineral. The barite is reported to be very pure, free from galena, and but slightly stained with iron oxide. An interesting occurrence of witherite, a carbonate of barium, is reported to have been discovered on the same property.

North Carolina.—In North Carolina barite has been mined in Madison County in the vicinity of Marshall and Hot Springs, and in Gaston County about 5 miles south of Bessemer City. In the former county it occurs in small seams or veins from 3 to 6 feet wide, and is free from impurities. In the latter county the barytes has been traced almost continuously for a distance of 2,400 feet. It occurs in a badly decomposed schistose rock, and certain portions are remarkably free from impurities. It has also been found near Hillsboro, Orange County; specimens of the mineral from this place show it to be of good quality, and it probably occurs in quantity.

Tennessee.—The barite deposits of Tennessee are in Bradley, Monroe, London, Cocke, and Greene counties. The Del Rind region, which is the most prominent, extends for a distance of 30 miles across Cocke and Greene counties, from Wolf Creek to Newport, and the barite outcrops at intervals throughout this distance. Barite mines are being worked near Niota, Sweetwater, and Cleveland. The barite deposits are associated with limestone, and in some instances there is more or less galena present.

Missouri.—The Missouri deposits of barytes, which have furnished the larger proportion of the barite mined in the United States, are located in Washington, Miller, and Cole counties, most of the mines being in the county first named. The mineral is associated for the most part with limestone, and in many places it is encountered right under the grass roots. More or less galena is associated with this barite, but some of the deposits are entirely free from it. At the surface it is apt to be stained more or less with iron oxide, but this becomes less and less as the deposits are worked deeper. The deposits are pockety, and the method of mining is by means of shallow shafts, pits, and open cuts. No deep mining has been undertaken, and the method now in use is termed locally "gophering." It is not at all probable that any definite vein formation will be encountered in deep mining; the barite will continue to be in pockets as far as it extends in depth. This does not mean that barite is not to be found in a solid vein formation or seam; but that where the general occurrence is like that in Virginia and Missouri there is little or no probability that the deposits will develop into a solid vein formation in depth. In Washington County the barite is found over a large part of the surface.

Where galena occurs with the barytes it is readily separated and does not interfere seriously with the preparation of the commercial product.

USES.

The uses of barite are somewhat varied. It is employed in the manufacture of paper, rubber, and paints, and also in the preparation of a material that is used to coat the canvas sacks in which hams are put up for sale. The first grade of barytes, which, after being ground and made ready for use, is known as "floated barytes," is used in the manufacture of paints by mixing it with white lead. Some of the barytes that is stained with iron and can not be used for paint is used in the manufacture of various salts of barium. Experiments are being made with barytes in the glass industry, but no practical results have as yet been made public. A considerable amount of barytes is used in the manufacture of barium hydroxide.

PRODUCTION.

The output of crude barytes in 1901 was 49,070 tons, valued at $157,844, a decrease of 18,610 tons from the production of 1900, which was 67,680 tons, valued at $188,089. There was a gradual decline in the price per ton, from $3.46 in 1898 and $3.33 in 1899 to $2.78 in 1900, which was partly due to the large production of low-grade barytes. In 1901, however, the average price per ton was $3.42, which is a decided increase over that of 1900, and is accounted for by the fact that a better grade of barytes was put on the market.

The States which produced barytes in 1901 are Virginia, North Carolina, Georgia, Tennessee, and Missouri, and the production of each is shown in the following table:

Production of crude barytes in 1901, by States.

State.	Quantity.	Value.
	Short tons.	
Virginia	10,270	$31,260
North Carolina *a*	7,390	22,615
Tennessee	10,460	30,155
Missouri	20,950	73,814
Total	49,070	157,844

a Including the small production of Georgia.

The annual production of crude barytes in the United States since 1882 is shown in the following table:

Production of crude barytes from 1882 to 1901.

Year.	Quantity.	Value.	Average price per ton.	Year.	Quantity.	Value.	Average price per ton.
	Short tons.				*Short tons.*		
1882	22,400	$80,000	$3.57	1892	32,108	$130,025	$4.05
1883	30,240	108,000	3.57	1893	28,970	88,506	3.06
1884	28,000	100,000	3.57	1894	23,335	86,983	3.73
1885	16,800	75,000	4.46	1895	21,529	68,321	3.17
1886	11,200	50,000	4.46	1896	17,068	46,513	2.73
1887	16,800	110,000	*a* 6.55	1897	26,042	58,295	2.23
1888	22,400	75,000	3.35	1898	31,306	108,339	3.50
1889	21,460	106,313	*b* 4.95	1899	41,894	139,528	3.33
1890	21,911	86,505	3.95	1900	67,680	188,089	2.78
1891	31,069	118,363	3.81	1901	49,070	157,844	3.22

a Value at St. Louis and includes some floated barytes.
b Value includes floated barytes when sold first in that form.

IMPORTS.

Barytes continues to be imported into the United States at the rate of a few thousand tons per year. It is obtained largely from Germany, and the crude ore is brought over as ballast.

The table below shows the amount of crude and manufactured barytes imported into the United States since 1867:

Imports of barytes from 1867 to 1901, inclusive.

Year ending—	Manufactured.		Unmanufactured.	
	Quantity.	Value.	Quantity.	Value.
June 30—	*Pounds.*		*Pounds.*	
1867	14,968,181	$141,273	....	....
1868	2,755,547	26,739	....	....
1869	1,117,335	8,565	....	....
1870	1,684,916	12,917	....	....
1871	1,385,004	9,769	....	....
1872	5,804,098	43,521	....	....
1873	6,939,425	53,759	....	....
1874	4,788,966	42,235	....	....
1875	2,117,854	17,995	....	....
1876	2,655,349	25,325	....	....
1877	2,388,373	19,273	....	....
1878	1,366,857	10,340	....	....
1879	453,333	3,496	....	....
1880	4,924,423	37,374	....	....
1881	1,518,322	11,471	....	....
1882	562,300	3,856	....	....
1883	411,666	2,489	....	....
1884	3,884,516	24,671	5,800,816	$8,044
1885	4,095,287	20,606	7,841,715	13,567
December 31—				
1886	3,476,691	18,338	6,588,872	8,862
1887	4,057,831	19,769	10,100,848	13,290
1888	3,821,842	17,135	6,504,975	9,037
1889	3,601,506	22,458	13,571,206	7,660
1890	*a* 1,563	16,453	*a* 4,815	13,133
1891	2,149	22,041	2,900	8,816
1892	1,389	15,419	2,789	7,418
1893	1,032	11,457	2,983	7,612
1894	836	10,556	1,884	5,270
1895	1,629	17,112	2,551	7,561
1896	2,467	23,345	509	1,274
1897	1,300	13,822	502	579
1898	687	8,678	1,022	2,678
1899	2,111	22,919	1,739	5,488
1900	2,454	24,160	2,568	8,301
1901	2,454	27,062	3,150	12,380

a Tons since 1890.

FULLER'S EARTH.

PRODUCTION.

There was a decided increase in the production of fuller's earth in 1901 over 1900. As usual the greater part of the product was obtained from the vicinity of Quincy, Fla. Small quantities were contributed by three other States—Arkansas, Colorado, and New York. The total production of fuller's earth in the United States in 1901 was 14,112 short tons, valued at $96,835, an increase over 1900 of 4,414 short tons, or 45 per cent. This is the largest production since 1898, when the United States produced 14,860 short tons. There was also an increase in the amount of fuller's earth imported into the United States.

Production of fuller's earth in the United States from 1895 to 1901, inclusive.

Year.	Quantity.	Value.	Year.	Quantity.	Value.
	Short tons.			*Short tons.*	
1895	6,900	$41,400	1899	12,381	$79,644
1896	9,872	59,360	1900	9,698	67,535
1897	17,113	112,272	1901	14,112	96,835
1898	14,860	106,500			

IMPORTS.

The amount and value of the fuller's earth imported into the United States in 1897, 1898, 1899, 1900, and 1901 are shown in the following table:

Fuller's earth imported into the United States during 1897, 1898, 1899, 1900, and 1901.

Class.	1897.[a]		1898.		1899.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Long tons.		*Long tons.*		*Long tons.*	
Unwrought or unmanufactured	2,308	$14,283	2,038	$15,921	3,743	$23,194
Wrought or manufactured	2,138	20,037	6,315	55,123	6,577	46,446
Total	4,446	34,320	8,353	71,044	10,320	69,640

[a] July to December, only.

Fuller's earth imported into the United States, etc.—Continued.

Class.	1900.		1901.	
	Quantity.	Value.	Quantity.	Value.
	Long tons.		*Long tons.*	
Unwrought or unmanufactured	2,431	$14,750	2,918	$17,230
Wrought or manufactured	5,742	50,047	7,851	63,467
Total	8,173	64,797	10,769	80,697

In the following table is shown the amount and value of the fuller's earth imported from 1867 to 1883, by fiscal years. The wrought and unwrought earths were not classified separately during this period. From July 1, 1883, to June 30, 1897, fuller's earth was not reported separately in the custom-house returns to the Treasury Department, but was included with other minerals "not elsewhere specified."

Imports of fuller's earth from 1867 to 1883, inclusive.

Year ending June 30—	Quantity.	Value.	Year ending June 30—	Quantity.	Value.
	Long tons.			*Long tons.*	
1867	280	$3,113	1876	246	$3,097
1868	211	2,522	1877	400	4,460
1869	324	3,587	1878	335	4,095
1870	239	2,619	1879	361	4,269
1871	290	3,383	1880	578	6,925
1872	274	3,358	1881	268	3,207
1873	251	2,978	1882	908	11,444
1874	277	3,440	1883	1,241	14,309
1875	300	3,694			

FULLER'S EARTH OF SOUTHWESTERN GEORGIA AND WESTERN FLORIDA.

By T. Wayland Vaughan.

INTRODUCTION.

The first fuller's earth discovered in the United States was at Quincy, Fla., in the year 1893. Beginning with 1896, a yearly account of the production, with more or less detail regarding the geologic occurrence of the deposits and with notes concerning newly discovered localities, has appeared in the Mineral Resources of the United States, published by the United States Geological Survey. Notes have been published on nearly all of the localities treated in this paper,[a] but more details and additional analyses with practical tests by Dr. Heinrich Ries are here given.

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[a] See particularly Seventeenth Ann. Rept. U. S. Geol. Survey, Pt. III (continued), pp. 876-880; Twenty-first Ann. Rept. U. S. Geol. Survey, Pt. VI (continued), pp. 589-592.

These deposits have never been mapped and can not at present be mapped satisfactorily, as the area in which they occur has never been topographically surveyed.

OCCURRENCE.

Extensive deposits of fuller's earth occur in the southern part of Decatur County, Ga., and in Gadsden County, Fla. They also occur in the western portion of Leon County, Fla. The following notes give the data which have been obtained by personal observations or through interviews with the residents of those regions. Occurrences of fuller's earth are reported from near Whigham, Ga., but the writer did not have an opportunity to visit them.

The stratigraphic position of the fuller's earth, excepting that from Alachua County, is Upper Oligocene. The stratigraphic relations and lithologic characters indicate equivalence with the Alum Bluff beds. Poor fossils were found in the fuller's earth at several localities. Several species were collected in the Chesebrough Manufacturing Company's mine at Quincy, Fla. A list is given on a subsequent page. They indicate an Upper Oligocene horizon.

GEORGIA.

DECATUR COUNTY.

Lester property near Attapulgus.—The material occurs in the southern and eastern slopes of the hills 1½ miles west of Attapulgus, Decatur County, Ga., where Mr. J. D. Lester has sunk ten pits, nine of them being on the south side of the road from Attapulgus to Faceville, and on the west side of Sanborn (or Little Attapulgus) Creek, and the remaining one on the east side of that creek. Martin Mill Creek runs east across the area in which the nine pits have been dug, and cuts below the level of the fuller's earth stratum. Three of the prospects are on the north side of the creek, and six are on the south side. The first three extend from the road to the creek. The distance between the outer prospects is about 700 yards. The distance across the prospects on the south side of the creek is about 400 yards. Fuller's earth was encountered in all of the prospects. The thickness on the north side of the creek at the foot of the hill was 2½ feet; on the south side it varies from 3 to 9 feet.

The section in the deepest pit shows the following strata:

Section in deepest pit on Lester property.

		Feet.
5. Soil and red clay	about	2
4. Blue clay	do	4
3. Grayish sand and fuller's earth	do	5
2. Fuller's earth	do	9
1. Whitish or bluish sand mixed with fuller's earth and containing a few poor fossils		1+

Thirty yards north of this pit, stratum No. 1 of the section given above was penetrated. It was 4 feet thick, and beneath it was blue clay mixed with fuller's earth.

The following gives the results of two analyses made by Dr. Heinrich Ries:

Analyses of fuller's earth from mines of Mr. J. D. Lester, Attapulgus, Ga.

Constituent.	1.	2.
	Per cent.	*Per cent.*
Silica	55.90	57.26
Alumina	12.40	18.33
Ferric oxide	2.40	1.87
Lime	1.00	2.58
Magnesia	8.12	1.06
Water	10.50	9.40
Moisture	9.40	9.00
	99.72	99.50

Two practical tests gave the following results: "In the first, mineral oils were bleached very nearly to the standard shade. In the second, the material showed with cotton-seed oil very fair bleaching qualities, but still was not quite equal to the English material."

In the well bored at Mr. Lester's house on the hill the fuller's earth strata were struck 42 feet beneath the surface. There was a small quantity of material 3 or 4 inches thick.

One pit was sunk on the east side of Little Attapulgus Creek on the southwest foot of the hill, and fuller's earth was encountered at a depth of 6 feet beneath the surface.

There is fuller's earth on the land of Mr. G. P. Wood which lies immediately south of that of Mr. J. D. Lester.

Connell property near Whigham.—As the writer was not able to visit the locality from which fuller's earth has been reported near Whigham, Decatur County, he makes the following extract from the Seventeenth Annual Report of the United States Geological Survey.[a]

> Several openings have been made on the land of Mr. R. A. Connell, south of Whigham, Ga. A rectangular pit 26 feet deep was sunk in the woods 1 mile south of Mr. Connell's house. The lower 6½ feet of the section exposed was fuller's earth, there being therefore an overburden of 19½ feet.
>
> An augur boring made in the bed of the creek a few hundred feet distant showed 10 feet overburden and 1 foot of fuller's earth. Some chert was found in the test pit. Other test pits were sunk on Sears Creek and Wolffs Creek on the same property, and both showed several feet of fuller's earth with 5 to 8 feet of overburden.

Near Withlacoochee Creek.—According to Mr. J. D. Lester, a mine on the west side of Withlacoochee Creek, about one-fourth of a mile northeast of the Georgia-Florida line, and 9 or 10 miles southeast of

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[a] Part III (continued), pp. 878–879.

Faceville, was opened by John Howard in 1896 or 1897 and was sold to the Owl Commercial Company in the same year. There was from 4 to 8 feet overburden of soil, clay, and white or brownish sand, and immediately above the fuller's earth a layer of bluish or reddish sandy clay; then 2 feet, or a little more, of fuller's earth, underlain by whitish argillaceous sandstone. The bed is not constant in character. On the north side of the road there is a sand seam in the fuller's earth. On the east side of the creek there is an exposure in the roadside. The overburden has been removed from an area of about 50 feet square. Several carloads of material have been piled up and placed under a shed.

This fuller's earth has not been chemically analyzed, but it has been practically tested by Dr. Heinrich Ries. It is of the same quality as that from the land of Mr. J. D. McPhaul, NE. ¼ sec. 16, T. 3 N., R. 4 W., Gadsden County, Fla. These two samples, when tested with cotton-seed oil, were found to bleach it as well as the Sumter material which was prepared and sent to Charleston. When tested with crude petroleum it was found not to bleach it quite so well as the original Quincy material.

Dr. Ries makes the following statement concerning the Sumter material:

> I have also received * * * a sample of supposed fuller's earth from Sumter, S. C., which came to me in a ground condition. I tested this with cotton-seed oil and am agreeably surprised to find that it bleached the material so well that it is almost impossible to distinguish the bleached sample of oil from one bleached by the English material. This material bleached petroleum practically as well as that from Quincy.

Cohn & Co.'s property near Attapulgus.—On Messrs. Cohn & Co.'s tobacco plantation, 4 miles southeast of Attapulgus, there is a deposit of this material. It is about 2 miles east of Mr. Getzlow's house, and immediately underlies the surface. It occurs in the flat pine woods, and the possibility of working large areas is good. There are about 3 feet of overburden, which is composed of soil, somewhat sandy for a few inches, and yellowish stiff clay about 2½ feet. The earth has been dug into to a depth of about 4 feet by Mr. Getzlow, but he does not know how much thicker it may be. This locality is between Attapulgus and Swamp creeks, about 8 miles south of the Savannah, Florida and Western Railway.

Mr. Getzlow states that the earth is generally distributed over the plantation near the creeks and along the small streams. Mr. Getzlow's residence, where there is also a store, is 4 miles southeast of Attapulgus post-office.

This material has not been tested or analyzed.

Mr. Mark W. Munroe is interested in some land on which fuller's earth occurs in the NE. ¼ sec. 8, and E. ½ sec. 5, T. 3 N., R. 3 W., in

Florida, and a fraction of one lot, a whole lot, and the western half of another lot in Georgia. According to Mr. Munroe, there is a strip about 2 miles long that can be mined.

FLORIDA.

GADSDEN COUNTY.

Near River Junction.—At this locality, 4 miles southeast of River Junction, is the former residence and the abandoned fuller's earth mine of Mr. Hymeson. Near the house is a shed that was used for storing the crude material. The mine is at the northern foot of the hill, between 150 and 200 yards from the store shed, and was connected with the latter by a tram up which the earth was hauled. Both the house and the mine are now abandoned. The unprepared material was hauled to River Junction, where a crushing mill had been erected.

The top of the hill on which the house stands is composed of grayish sands containing many small ferruginous concretions.

A section beginning at the top of the hill gives the following exposures:

Section beginning at the top of the hill on the Hymeson property.

	Feet.
4. Surface sands, beneath which are reddish sands containing some quartz gravel	60
3. Stiff blue clay, the top of the fuller's earth deposit	4
2. Fuller's earth. A considerable amount of the overburden had been thrown off, but due to weathering and wash there is really no good exposure. Judging from what can now be seen, according to a roughly leveled section, it seems that the deposit is at least 8 feet thick, and it may be thicker. There is no means of determining its horizontal extent. A box of the earth was collected from the best exposure.	
1. Immediately beneath the fuller's earth there appears to be a deposit of sandy, very stiff blue clay. Thickness unknown.	

The following is the generalized section, according to aneroid readings made in the vicinity of River Junction:

Generalized section near River Junction.

	Feet.
Surface sands	60
Clay and fuller's earth	10
Not exposed, but probably argillaceous sands	17
Chattahoochee chalk or limestone with some layers of marl about	88
The rocks beneath the Chattahoochee formation are not exposed near River Junction.	

The inference from this section apparently would be that the Chattahoochee limestone is 88+ feet in thickness, separated by 17 feet of unexposed strata from the deposit of fuller's earth, which would come above. This would stratigraphically correlate the deposit of fuller's earth with the Alum Bluff beds.

The following is the detailed description and section of Rockbluff on the Apalachicola River published by Dall and Stanley-Brown.[a] The writer is of the opinion that the fuller's earth horizon corresponds to No. 3 of their section.

The lower part of the bluff formed by the Chattahoochee limestone is vertical, rising 12 feet above the water, and presumably nearly as much below it, at low stages of the river. Above this is a mass of marl varying from bluish green to gray in color, weathering white, more arenaceous below and more marly above, replete with oyster shells, a fine, large *Anomia*, a pecten, like young *madisonius* (but, as observed by Foerste, only four-sevenths the size of that species; it is really a Chipola species), *Turritella*, and many *Balani*. This assemblage of species indicates a shallow water oyster-reef fauna, unquestionably belonging to the old Miocene [Upper Oligocene] and forming the shoal-water equivalent of the Chipola and Alum Bluff beds, especially the latter. Above this marl lie the red Lafayette clays and gravels—in this case worked-over materials—variable in thickness, owing to denudation, but apparently averaging about fifteen feet, and covered with a thin layer of superficial soil and sand. This section was carefully measured with a steel tapeline, due allowance being made for the inclination of the tape from the vertical. It shows the finest and thickest section of the greenish marl exposed anywhere on the river. The contact of the marl with the Chattahoochee limestone is distinct and without apparent unconformity or transition beds of any kind.

The section was measured on the highest part of the bluff, which is the first approached as the turn of the river is made in descending.

Section of Rockbluff, Apalachicola River, Florida.

	Feet.
1. Superficial sands, thin and variable, say	3
2. Reddish clayey sand and gravel, about	15
3. Greenish-white compact marl, with fossils	67
4. Chattahoochee limestone, to water	12
Total thickness above water	97

Mr. Max Hymeson, who was the owner of the fuller's earth mine known by his name, left River Junction, thus causing the mine to close down. Mr. A. S. Anderson, of Dunellen, Fla., was the manager of the works. Various reports came to the writer as to why the mine was closed. One was that work was discontinued because of lack of funds and Mr. Hymeson's departure. Another report was that the earth did not prove commercially valuable; that it could be used in small quantities, but that when it was used in large quantities as a filter for oils explosions resulted.

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[a] Bull. Geol. Soc. America, Vol. V, 1894, pp. 155, 156.

The following gives the results of an analysis and practical tests made by Dr. Ries:

Analyses of fuller's earth from the Hymeson mine.

Constituent.	Per cent.
Silica	59.00
Alumina	15.05
Ferric oxide	2.95
Lime	.20
Magnesia	3.70
Water	11.40
Moisture	7.80
Total	100.10

Fuller's earth from the Hymeson mine, 3 miles south of River Junction, the sample having been taken from the crusher at River Junction, Fla. This exerted only a moderate bleaching action on the cottonseed oil, and would not bleach mineral oils very well.

Mr. William Bruce states that there is fuller's earth near River Junction, halfway between that place and the Hymeson mine, near the top of the hill. He says that there is also some fuller's earth near Rockbluff, back from the bluff, in the ravines among the hills. The writer did not see these places.

Mosquito Creek.—There is an exposure of fuller's earth on the south bank of Mosquito Creek, near the foot of a bluff, on land belonging to Mr. John D. McPhaul. The overburden is here too great for working. The deposit is along a small stream running north into Mosquito Creek in the NW. ¼ sec. 16, T. 3 N., R. 4 W. A sample was taken at this locality where a pit had been sunk.

A section in the pit shows overburden (sand), 4 feet; fuller's earth, 6 feet. The bed was not completely penetrated.

The following is an analysis by Dr. Heinrich Ries of fuller's earth from the NE. ¼ sec. 16, T. 3 N., R. 4 W., Gadsden County, Fla., from land of Mr. J. D. McPhaul:

Analysis of fuller's earth from the McPhaul property.

Constituent.	Per cent.	Per cent.
Silica	58.50	62.85
Alumina	14.30	15.36
Ferric oxide	2.10	2.25
Lime	1.30	1.39
Magnesia	6.50	6.98
Alkalies	1.80	1.93
Water and CO_2	9.5	10.20
Moisture	7.00	....
	101.00	100.96

Dr. Ries remarks: "As the moisture contents of this sample was so large I have in the second column given the analysis with the moisture deducted and the percentages recalculated on the basis of the remainder being 100 per cent."

The material was also exposed in the bed of a creek nearby. The slope down to the creek valley is gradual. A strip several hundred yards wide and probably half a mile long could be worked. Fuller's earth occurs also on the land of Mr. A. J. Key, in sec. 15, T. 3 N., R. 4 W.; and on the land of Mr. Elias Howell, in sec. 10, T. 3 N., R. 4 W., and extends also along the creek about one-half mile below Mr. McPhaul's.

Dr. Ries states that this earth is very similar to that on Withlacoochee Creek, 8 miles north of Quincy. Both bleached cotton-seed oil, as well as the Sumter, S. C., material, but did not bleach crude petroleum quite as well as the original Quincy material.

Near Quincy.—The following is a section through the fuller's earth at the Chesebrough Manufacturing Company's mine, 1 mile south of Quincy. The section was given by Mr. T. L. Ward.

Section of Chesebrough Manufacturing Company's mine.

	Feet.
5. Overburden of clay and sands	7
4. Fuller's earth (average)	4
3. White argillaceous sandstone containing fossils	5
2. Fuller's earth	9
1. Soft sandstone, sand, and fuller's earth	15

It is estimated that there are about 10,000 tons to the acre. The mine was visited in company with Mr. Ward. About 2 acres have been mined, and 20,000 tons were taken out. Mr. Ward states that operations were begun in 1895, and closed down in December, 1899, because the Standard Oil Company had sufficient earth on hand for the present. Bed No. 3 contains numerous poor fossils. Several species were collected, of which the following is a list:

List of fossils collected from fuller's earth mine of Chesebrough Manufacturing Company, near Quincy, Fla.

Cypraea, agreeing in form and size with *C. pinguis* Conrad from the Chipola horizon.

Murex mississippiensis Conrad? var.
Fulgur spiniger Conrad?
Modulus sp.
Crucibulum auricula Gmelin.
Arca staminata Dall.
Pecten (Nodipecten?) sp.
Cardita serricosta Heilprin.
Chione sp.

These fossils indicate an Upper Oligocene horizon, corresponding stratigraphically with No. 3 of Dall and Stanley-Brown's Rock Bluff section, which was given on a preceding page.

A specimen of *Carolia floridana*, Dall, from the fuller's earth horizon at Quincy, is in the United States National Museum. This is considered an index fossil of our Upper Oligocene.

An examination of the section at the Owl Commercial Company's mine disclosed the following exposure:

Section of the Owl Commercial Company's mine.

	Feet.
4. Overburden	5 to 20
3. Fuller's earth	6 to 10
2. Sandstone containing crystals and lumps of calcite or aragonite	3 to 4
1. Fuller's earth	5 to 6

The mining is done by stripping.

Fuller's earth occurs along Quincy Creek above the Owl Commercial Company's works, about 1½ miles west of Quincy, on land belonging to Mr. William Bruce, in sec. 12, T. 2 N., R. 4 W. A specimen taken from an augur bore was donated by Mr. Bruce. The overburden along the creek flat is 4 or 5 feet thick. Mr. Bruce also donated some pieces of the material which came from a pit that is at present filled with water. A pit has also been dug in sec. 2, T. 2 N., R. 4 W., on land belonging to Messrs. Taussig & Wedeles. Some pieces were picked up out of the dump around this hole. The overburden is from 4 to 5 feet thick, the same as on Mr. Bruce's land.

The fuller's earth in these localities has not been thoroughly explored. It seems to be of good quality, the overburden is not great, and the land is flat. Transportation by railroad is within one-half to three-fourths of a mile. From what Mr. Bruce says, the deposit is thick enough for profitable working—about 8 feet.

The following gives the results of the analyses and practical tests made by Dr. Ries:

Analysis of fuller's earth from land of Messrs. Taussig & Wedeles.

Constituent.	Per cent.
Silica	60.70
Alumina	14.10
Ferric oxide	2.40
Lime	1.65
Magnesia	2.08
Water	9.70
Moisture	9.30
Total	99.93

Sample from the land of Taussig & Wedeles, sec. 2, T. 2, R. 4 W. This did not bleach very well.

Analysis of fuller's earth from land of Mr. William Bruce.

Constituent.	Per cent.
Silica	60.80
Alumina	15.45
Ferric oxide	1.95
Lime	1.60
Magnesia	3.12
Water	9.90
Moisture	6.90
Alkalies	.70
Total	100.42

Two practical tests gave the following results: "First, this in its bleaching power on cotton-seed oil was but moderate and behaved similarly to the specimen from the Hymeson mine. Second, this bleached the petroleum very well to the standard shade adopted by the Standard Oil Company."

At a farm near the residence of Mr. Carmen, who lives 4 miles east of Quincy, outcrops of fuller's earth occur along the creeks and in the hillsides. No samples were taken.

Seven miles east of Quincy are other outcrops.

LEON COUNTY.

Twelve miles west of Tallahassee, on property belonging to Messrs. W. H. Allen and sons, are occurrences of fuller's earth. Several pits have been sunk by Mr. Rosendale. The overburden is about 6 feet, and there are about 8 feet of fuller's earth. The writer was not able to get fresh specimens, hence pieces from the dump were selected. The land lies rather flat, along a small creek running into the Ochlockonee River.

The following gives the results of two practical tests by Dr. Ries:

(1) Sample of fuller's earth from the land of Mr. W. H. Allen, 12 miles west of Tallahassee. I was not able to make this bleach mineral oil, or at any rate the bleaching action was slight, although I tried twice.

(2) Sample of fuller's earth from 12 miles west of Tallahassee, on the land of Mr. W. H. Allen. This bleached the cotton-seed oil fairly well, but was not equal to the English material.

A section on the Sea Board Air Line Railway, about 1 mile east of Tallahassee, at milepost 163, shows the following exposures:

Section on Sea Board Air Line Railway.

3. The upper 25 or 30 feet at the ends of the cut are reddish, yellowish sands.
2. Sands with clay partings, 5 to 10 feet.
1. Whitish or bluish clay resembling fuller's earth in thin laminæ with sand partings 4 to 5 feet.

In a curve in the railroad track between mileposts 163 and 164 is another cut between 15 and 20 feet deep, and the same section as above described was again seen. The clay at the base resembles more closely fuller's earth than that in the first-described section. It contains less sand.

ALACHUA COUNTY.

Devil's Mill Hopper.—This is a lime sink several hundred yards in diameter and over 100 feet in depth in the Vicksburg limestone. It is situated about 11 miles from Alachua, Fla., and 5 or 6 miles from Gainesville, on the road between the two places. A thin stratum of fuller's earth, apparently interbedded with the limestone, was discovered in the side of this sink.

ANALYSES.

A large number of analyses of fuller's earth have appeared in Mineral Resources of the United States, published by the United States Geological Survey. As these analyses may be of interest for comparison with those given above, all of them have been tabulated and are presented below. Analyses of the Sumter, S. C., earth, made by Dr. Heinrich Ries, are included.

Analyses of fuller's earth in the United States.

	SiO_2.	Al_2O_3.	Fe_2O_3.	CaO.	MgO.	H_2O.	Na_2O.	K_2O.	Moisture.	Loss on ignition.	FeO.	Volatile matter.	MnO.	Total.	Analyst.
	Per ct.	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	
Gadsden County, Fla	62.83	10.35	2.45	2.43	3.12	7.72	0.20	0.74	6.41					96.25	P. Fireman.
Decatur County, Ga	67.46	10.08	2.49	3.14	4.09	5.61			6.41					99.15	Do.
Fairburn, S. Dak	58.72	16.90	4.00	4.06	2.56	8.10	2.11		2.30					98.45	E. J. Reiderer.
SE. of River Junction, Fla	50.70	21.07	6.88	4.40	.30	9.60			7.90					100.95	Do.
Between Mount Pleasant and Norway, Fla.	58.30	10.63	6.72	1.71	3.15	9.05			9.55					99.11	Do.
Near Norway, Fla	54.60	10.99	6.61	6.00	3.00	10.30			7.45					98.95	Do.
North of Fairburn, S. Dak	68.23	14.93		2.93	.875					6.20	3.15			96.31	State School of Mines, Rapid City.
Custer City, Ind. T	55.45	18.58	3.82	3.40	3.50	8.8						5.35	Trace.		F. E. D. Heinault.
Do	57.00	17.368	2.362	3.00	3.027	9.5						5.85	Trace.		Do.
Do	63.50	14.97	4.48	2.40	2.882		7.20	1.116				{Co_2 & vol. 10.75}			J. E. Pilcher.
Hermosa, Ind. T	55.40	27.70	1.80	2.30	.703		4.87	.589					{Loss 13.00}		Geo. Boland.
Custer City, Ind. T	71.28	14.33	2.484	.33	1.199	{Alk. und.}						{Alk. und.}			A. M. Willard.
¾ miles from Fairburn, S. Dak	68.23	14.93	3.15	2.93	.875	6.20									Wm. Bodenner.
Fairburn, S. Dak	60.16	10.38	14.868	4.96	1.714	{Ign. 7.20}									M. Palmiter.
Fairburn, S. Dak. (dried)	56.18	23.23	1.26	5.88	3.29	11.45									Do.
Fairburn, S. Dak	67.00	5.00	12.00			15.00									Wm. Bodenner.
"Glacialite," Enid, Okla	50.36	33.38	3.31			12.05						{Trace TiO_2}	{Org. trace}		
Tampa, Fla	70.78	11.38		2.18					15.71					100.00	Prof. F. W. Clarke.
Florida.[a]	36.73	27.78	3.21	.81	.64	{[b] 7.38 [c] 12.14}	None.	.42							
Sumter, S. C	71.20	10.10	1.80	1.90	2.10	5.70	1.60		2.50					99.90	H. Ries.
Do	71.90	10.25	1.75	1.30	2.30	5.80	1.75		1.70					99.75	Do.

[a] In addition this specimen contained 5.54 per cent P_2O_5; 1.27 per cent TiO_2, and 3.61 per cent of organic matter.

[b] At 110°.

[c] Above 110°.

Analyses of fuller's earth from foreign countries.

	SiO_2.	Al_2O_3.	Fe_2O_3.	CaO.	MgO.	H_2O.	Na_2O.	Alkalies.	Moisture.	Ignition.	Total.	Analyst.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	
Smectite from Cilly	51.21	12.25	2.07	2.13	4.89	27.89	....	....	....	....	100.44	Pogg. Ann., Vol. lxxvii, p. 591, 1849.
Reigate	53.00	10.00	9.75	.50	1.25	24.00	....	....	....	....	98.50	
Malthite from Steindorfel	50.17	10.66	3.15	.25	....	35.83	....	....	....	....	100.06	Dana, System of Min.
England	44.00	11.00	10.00	5.00	2.00	....	5.00	....	....	....	77.00	Geikie, 1893, p. 133.
Do	44.00	23.06	2.00	4.08	2.00	24.95	....	....	....	....	100.09	Dr. Thompson.
Woburn sands (yellow)	47.10	16.27	10.00	2.63	3.15	....	....	....	15.12	5.73	100.00	R. H. Harland.
Woburn sands (powdered)	47.20	15.66	10.64	2.24	2.00	....	....	.46	15.44	5.36	99.00	Do.
Woburn sands (blue, undried)	40.50	12.20	6.80	1.57	1.00	....	....	1.15	33.50	3.25	99.97	Do.

FLINT AND FELDSPAR.

By Heinrich Ries.

INTRODUCTION.

Feldspar and quartz are widely distributed in igneous and metamorphic rocks, such as granites and gneisses, but usually so intimately intermixed with other minerals, such as mica or hornblende, that their extraction and concentration can not be carried on profitably; it is, therefore, only when occurring in large masses of considerable purity that they become of commercial value. The ordinary sources of supply are pegmatite and quartz veins, and, in rarer instances, residual cherts. Many quartzites or sandstones are also of sufficient purity to be ground for potters' purposes, and in Europe large quantities of quartz are found in the form of flint nodules, occurring in the chalk of England, France, and Denmark.

In the United States it is the vein type of deposit which is commonly drawn upon to supply the quartz and feldspar used in the pottery industry. Veins of this kind may be found throughout the crystalline areas of New England, and also in the Appalachians as far south as Alabama. In the northern States—that is, in those lying north of the terminal moraine—the vein may often present a prominent outcrop; but in the southern States, or from Philadelphia southward, the upper part of the vein, especially if it contain feldspar, is often weathered to kaolin, so that the solid fresh feldspar, and sometimes quartz, is not found until the limit of weathering is reached. In such cases the vein may have been originally worked as a kaolin mine, but, with the giving out of the clay, has since been operated for its feldspar contents.

The fine sand which is washed out in the purification of the kaolin is also at times sufficiently free from iron oxide to permit its sale for potters' use, or, in other cases, for glass manufacture.

FLINT.

PRODUCTION.

The production of flint or quartz in 1901 amounted to 34,420 short tons, valued at $149,297, which was an increase of 1,925 short tons in quantity, and of $62,946 in value. This difference was chiefly due to the higher price per ton reported for flint, resulting from the greater market demand for it.

Of the output 51.3 per cent was ground by the producer. The production for 1901 is given below, the value being that given at the mines.

Production of flint in the United States in 1901, by States.

State.	Crude.		Ground.	
	Quantity.	Value.	Quantity.	Value.
	Short tons.		*Short tons.*	
Maryland	1,818	$2,929	5,030	$37,000
Pennsylvania	5,079	9,318	2,149	13,280
Wisconsin			([a])	([a])
Connecticut	7,320	15,320	10,464	[b] 68,325
Maine	([c])	([c])	([c])	([c])
New York	2,560	3,125		
Total	16,777	30,692	17,643	118,605

[a] Included with Pennsylvania. [b] Includes Massachusetts. [c] Included with Connecticut.

The above figures do not represent the entire amount of flint consumed annually in the United States, for much is imported from Europe in the form of rolled flints. The flint nodules thrown out of the chalk by the whiting manufacturers are also sold for pottery use.

The production of flint in the United States from 1892 to 1901, according to corrected figures, is as follows:

Production of flint in the United States from 1892 to 1901.

Year.	Crude.		Ground.		Total.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Short tons.		*Short tons.*		*Short tons.*	
1892	[a] 22,400	$80,000			22,400	$80,000
1893	[a] 33,231	63,792			33,231	63,792
1894	[a] 42,560	319,200			42,560	319,200
1895	[a] 13,747	21,038			13,747	21,038
1896	[a] 12,458	24,226			12,458	24,226
1897	[a] 13,466	26,227			13,466	26,227
1898	[a] 21,425	42,670			21,425	42,670
1899	[a] 29,852	180,345			29,852	180,345
1900	18,611	34,553	13,884	$51,798	32,495	86,351
1901	16,777	30,692	17,643	118,605	34,420	149,297

[a] Includes both ground and crude.

USES.

The product of flint, like feldspar, is used chiefly for pottery manufacture and other higher branches of the clay-working industry, but some is used in the manufacture of scouring soaps and wood fillers.

Mr. S. G. Burt,[a] in a paper on the "Fineness of flint and its relation to the manufacture of pottery bodies," concludes that there is little, if any, difference in the effect produced by the use of French flint, silica sand, or rock flint (vein quartz), and that, consequently, equally good results can be obtained by the use of any of these varieties of quartz. Variation in the degree of fineness to which they are ground may, however, cause trouble.

FELDSPAR.

OCCURRENCE.

The commonest species of feldspar is orthoclase or potash feldspar, and it is the one commonly used by potters in this country. It is the most infusible member of the feldspar group, but thus far very little of the other species has been found in sufficient quantity and purity to mine.

Veins of feldspar are now worked in New York, Pennsylvania, Maryland, Connecticut, and Maine. None was reported from Massachusetts in 1901.

The attention of those searching for feldspar is directed to the large quantities of labradorite feldspar rock occurring in the Adirondacks and often running quite low in iron oxide.

The following analysis indicates the composition of feldspar quarried at Bedford, N. Y:

Analysis of spar from Bedford, N. Y.

Constituent.	Per cent.
Silica	64.97
Alumina	20.85
Ferric oxide	Trace.
Alkalies	13.72
Water	.46
Total	100.00

PRODUCTION.

The production of feldspar in 1901 showed an increase over 1900, and amounted to 34,741 short tons, valued at $220,422. Of the product 71.3 per cent was ground by the producer, as against 84.1 per cent in 1900.

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[a] Trans. Am. Cer. Soc., Vol. III, p. 17.

The production of the ground and crude spar for the year 1901 was reported as follows, the value given being that at the mines:

Production of feldspar in the United States in 1901, by States.

State.	Crude.		Ground.	
	Quantity.	Value.	Quantity.	Value.
	Short tons.		*Short tons.*	
Connecticut	3,514	$4,902	7,275	$49,956
Maine	896	2,400	(a)	(a)
New York	1,060	1,000	3,344	20,600
Pennsylvania and Maryland	4,490	13,367	14,162	128,197
Total	9,960	21,669	24,781	198,753

[a] Included with New York.

The above figures do not show the entire amount of spar consumed in this country annually, for some is imported from Canada. The Canadian material is a red orthoclase, which, in spite of its color, contains little or no iron, and calcines white. Its composition is shown by the following analysis:

Analyses of red feldspar from Bedford, Ontario, Canada.[a]

Constituent.	Per cent.	Per cent.
Silica	66.23	65.40
Alumina	18.77	18.80
Ferric oxide	Trace.	Trace.
Potash	12.09	13.90
Soda	3.11	1.95
Lime	.31	
Loss on ignition		.60
Total	100.51	100.65

There are said to be two veins of this spar, one 60 and the other 150 feet wide. The output for the three months ending March 1, 1901, is said to have been 4,000 tons and to have been shipped to Trenton for use in pottery manufacture.[a]

The production of feldspar for the last ten years, according to corrected returns, is as follows. The figures since 1895 represent the information collected directly by the Geological Survey and are more approximately correct than those for preceding years.

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[a] Report of the Bureau of Mines (Ontario), 1901, p. 26.

Production of feldspar from 1892 to 1901, inclusive.

Year.	Crude.		Ground.		Total.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Short tons.		*Short tons.*		*Short tons.*	
1892	[a] 16,800	$75,000	....	....	16,800	$75,000
1893	[a] 20,578	68,307	....	....	20,578	68,307
1894	[a] 19,264	167,000	....	....	19,264	167,000
1895	[a] 8,523	30,000	....	....	8,523	30,000
1896	[a] 10,203	35,200	....	....	10,203	35,200
1897	[a] 12,516	43,100	....	....	12,516	43,100
1898	[a] 13,440	32,395	....	....	13,440	32,395
1899	[a] 24,202	211,545	....	....	24,202	211,545
1900	1,787	7,259	23,034	173,712	24,821	180,971
1901	9,960	21,669	24,781	198,753	34,741	220,422

[a] Includes the ground product.

USES.

The feldspar produced in the United States is used chiefly in the manufacture of pottery and wall and floor tiles, but it is also much employed in the manufacture of wood fillers and of scouring soaps, and in glass manufacture.

Mr. J. G. Rhodin, of Manchester, England, has recently described a method for the manufacture of potash salts from feldspar on a commercial scale.[a] It consists in heating a mixture of finely ground spar with slacked lime and common salt, at about 900° C. By this means from 80 to 90 per cent of the potassium in the mineral is extracted in the form of potassium chloride.

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[a] Eng. and Min. Jour., August 24, 1901.

CHROMITE OR CHROMIC IRON ORE.

By Joseph Hyde Pratt.

INTRODUCTION.

In the report for 1900 a detailed description was given of the occurrences of the mineral chromite, which is the source of chromic iron ore, together with a discussion of its chemical composition and a list of localities where it is found. In the present report more attention is given to the uses of chromite as a mineral, and of the salts and alloys of the metal chromium. Although there has been but little chromite mined in the United States during the last few years, there are certain purposes for which the mineral is beginning to be used that should cause some of the deposits not now worked on account of their distance from the point of consumption to become productive by bringing a market nearer to them. Some of the deposits are at long distances from the railroad, so that their ores can not be transported in competition with ores more favorably located. With the completion of the railroad that is now building from Erwin, Tenn., to Marion, N. C., a promising deposit near Burnsville, Yancey County, N. C., should become available. It is not improbable then that with new uses for it as a mineral, and with increased transportation facilities, chromite may again in a few years be one of the minerals produced in the United States.

USES.

The uses of the mineral chromite are somewhat varied, and can readily be brought under three heads:

1. Uses of the mineral itself.
2. Uses of chromium alloys.
3. Uses of chromium salts.

There is no direct use of the metal itself in the arts. Metallic chromium has been prepared by intensely heating the oxide with charcoal, or by reducing, at high temperatures, the chromium chloride with zinc. The metal obtained in this way is as hard as corundum, and is more infusible than platinum. According to the Journal of the Franklin Institute of Philadelphia,[a] good deposits of chromium can be obtained on a carbon cathode, or on platinum, brass, or lead, by means of a divided cell containing a chromic salt at the cathode and an acid or saline solution at the anode. The electrolytic chromium obtained in this way is bright gray and lustrous, but it has a tendency to peal, due probably to films of an oxide.

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[a] November, 1901: and Eng. and Min. Jour., November 16, 1901.

1. Chromite as a mineral is used in the manufacture of bricks for basic open-hearth furnaces. One method of preparing these bricks is by the mixture of chrome ore, bauxite, and milk of lime. The Harbison and Walker Company, of Pittsburg, Pa., has, during the last few years, made very extensive experiments regarding the manufacture of chrome bricks, and is producing a brick that is giving very good satisfaction. These bricks have been used as linings for a number of furnaces, and at one furnace over 400 heats were turned out before the lining had to be replaced. Although the price of these chrome bricks is considerably higher than that of silica bricks, yet on account of their lasting so much longer they are much more desirable. They are also found to be useful for quick repairs in a furnace while it is running at full heat, as the chrome bricks are not affected by either sudden heating or sudden cooling. Their use in the back walls of gas-ports has decreased, and a magnesia brick has, as a rule, been substituted for them.

Another use that is being advocated for the mineral chromite is as a hearth lining for water-jacket furnaces in copper smelting, and this use has already begun to a limited extent. In general, it may be said, that wherever chromite has been thoroughly tried in this way it has given satisfaction. There are a number of reasons why chromite is well adapted for this purpose: It is infusible; it does not become friable when heated and cooled; it is not affected, practically, at all by sudden heating or cooling; it is not attacked by the products formed in the fusion of the copper ore; and, on account of its hardness, it will be worn away but slowly by the flow of the fluids over it. A number of requests for information as to the employment of chromite for this purpose have been received. At the Richmond meeting (1901) of the American Institute of Mining Engineers, Mr. William Glenn, of Baltimore, presented an interesting paper on The Use of Chromite as a Hearth Lining for a Furnace Smelting Copper Ore. This paper gives the results of the construction of a chrome-ore bottom for a water-jacketed cupola copper furnace built at the Elizabeth mine in Stratford, Vt. The work done on this furnace was under the management of Mr. James W. Tyson, jr., of Baltimore. The method of construction of the bottom of the furnace, which was to contain the chrome ore, is described as follows:

> To contain the chrome ore and form with it the furnace bottom, he constructed a cast-iron basin with surrounding flange, the outer edges of which coincided with the exterior walls of the water jacket. The bottom of the basin is a united arch of 36-

inch cord and 12-inch versed sine, and 1 inch in thickness, except the flanges, which are 1.5 inches thick. It is in two sections, each of which is 5 feet 7 inches long. Each section is reinforced by three ribs, 1 inch in thickness and depth, by means of two of which the sections were bolted together with an asbestos gasket in the joint. The two outer ends of the basin were closed by segments which were cased with the sections. The basin was supported by ten jackscrews placed under its flanges, and was thus held securely up against the bottom of the water jackets, leaving free for inspection the entire underside of the basin. The chrome ore was filled into the basin, just filling the basin and reaching no higher than the bottoms of the four water jackets which form the four walls of the cupola. The ore used was of all sizes, from 10-inch cubes and downward through all dimensions even to dust.

Mr. Glenn states that no perishable cementing material was employed; the lumps of ore were fitted in as well as possible; the interstices were then filled in with smaller lumps, which were hammered in; and finally, the cracks were filled with ground ore, thus making the bottom of the furnace consist of well-packed ore. A course of fire bricks, standing on end, was laid over the whole of the chrome-ore hearth. It has not been determined what depth of fire brick should be employed, or whether any covering at all is needed. This chromite cupola bottom has given good satisfaction for over a year, where a corresponding fire-brick bottom would not have lasted more than a week.

A blister-copper reverberatory furnace was erected at the same mine in Stratford, Vt., and chromite was used in the hearth and adjacent walls, the bridge wall being entirely constructed of chrome ore. The slag line of the hearth was built around with chrome ore, and neither this nor the bridge wall has shown any noticeable attack upon them.

Our experience leads us to believe that the bridge wall of a blister-furnace should be lined with blocks of chrome ore, compacted, as far as possible, and that the slag line of the furnace hearth should be formed of blocks of chrome ore about 10 inches in height. We would build the larger blocks into the walls, as best we could, and then wedge the smaller ones in among them. The work would appear rude and unskillful when looked upon after completion. Blocks of chrome ore are rough in outline; they do not readily lend themselves to wall building. There is no mortar wherewith to form an inviting exterior to the work, and there is no other deceitful adjunct present.

Chrome ore has been used to some extent, or is about to be tried, at the Ducktown furnaces at Ducktown, Tenn. The results that have been obtained from practical tests of the use of chromite in this capacity, and its known resistance to all kinds of acids and fused slags, which has been demonstrated in the laboratory, go to prove that as the mineral becomes better known among copper smelters it will be more universally used, and the smelters will find it true economy to make the linings of the furnaces of chrome ore. It is very probable that as more practical tests are made chrome ore will prove equally available and useful in other furnaces and converters, and its use will permit of a more general use of the mineral fluorspar as a flux in smelting different ores. As far as can be determined, it is not necessary to use what are considered the best chromic iron ores, those that contain 50 per cent or more of chromic oxide; the lower grades of ore, carrying 40 per cent and upward of chromic oxide, are just as serviceable, and these ores are much more available and cheaper.

This use of chromite should produce a demand for the chromite ores of North Carolina, which would be available for the smelters at the Virgilina copper district of Virginia and North Carolina, the Ore Knob and Gold Hill copper districts of North Carolina, and the Ducktown district of Tennessee. In the same way the chromite deposits of California should become available for the same purpose in the copper districts of Arizona, Utah, and Montana.

2. The principal use of chromium as an alloy is in the manufacture of ferro-alloy, and this has become a very important industry. The ferro-chromium alloy is used in the manufacture of chromium steel, which finds its greatest use in armor plate and armor-plate-piercing projectiles. The armor plates are usually made by the addition of the alloys, ferro-chromium and ferro-nickel, to the molten steel before it is cast into the ingot, and they produce a more or less homogeneous triple alloy. Chromium in the presence of carbon makes steel intensely hard. At the same time it gives steel a high power of resistance to shock, which adapts it especially to use for armor plate, and also to any severe service, and to resistance to abrasion, as in trolley-car wheels, crusher jaws, stamp-mill shoes, etc. A chrome steel is now being made for use in the manufacture of safes.

In the manufacture of a ferro-chromium alloy it is necessary to use a high-grade chromium ore low in silica, which, on account of its refractory character, can be reduced only by the employment of electric heat. One of the largest companies manufacturing the ferro-chromium is the Wilson Aluminum Company,[a] whose works are located at Holcombs Rock, Bedford County, Va., and at Kanawha Falls, Fayette County, W. Va. The company needed in its work a powerful electric current which could be secured at a minimum of cost, and it has found these conditions in the two States mentioned. At Kanawha Falls, about 2 miles below the junction of New and Gauley rivers, which form the Great Kanawha River, there is one of the finest water powers in the State. The river at this point has a nearly vertical fall of 26 feet, and it has been estimated that at its lowest stage it is capable of developing 8,000 horsepower. The course of the river has been turned into the sluiceway by means of a dam which has been built on solid rock just above the falls. On the north side of the river an electric plant has been installed that is capable of generating 3,000 electric horsepower. The generators used are four 300-kilowatt

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[a] The Iron Trade Review, September 12, 1901.

3-phase Bullock generators and three 600-kilowatt 3-phase Bullock generators. To utilize the remaining available power, the company intends to erect another electric plant on the south side of the river. By means of the electric current thus generated the enormous heat necessary to reduce the chrome ore can be produced. The alloy as produced by this company contains about 70 per cent chromium. The works at Holcombs Rock, Va., are also extensive, are very favorably located, and have ample water power.

3. The chief use of chrome ores notwithstanding the two uses described above, still is in the production of the salts, chromate and bichromate of potash, which are used particularly in dyeing and in the manufacture of coloring pigments. The use of these salts as coloring pigments was discovered about 1800, and, although at that time the discoverer thought that they might have valuable application in the arts, he was not able to determine this definitely on account of the rarity of the mineral crocoite, which was his source of chromium. With the discovery of the chromic iron ore or chromite, however, it was soon demonstrated that these chromates of potash were very important coloring pigments. They have become practically indispensable in the manufacture of textiles for many shades of buff, red, brown, and black. Artists require them for producing the purer tints of red and yellow, which are used in coloring and tinting pottery and upon various other kinds of objects. It has also been found that these alkali bichromates can be used advantageously in tanning skins. Some of the chromium salts are also used for medicinal purposes. Their greatest use, however, is still as coloring pigments.

OCCURRENCE.

With the exception of alluvial deposits, chromite has been found only in the peridotites and allied igneous basic magnesian rocks, or in the serpentines which have resulted from the alteration of these rocks. The mineral does not occur in well-defined veins, but is found in masses or pockets, which apparently have no relation whatever to one another. On account of this pockety nature of the deposits, the mining of chromite, especially in the United States, has always been attended with considerable uncertainty; and for this reason chromite properties are more apt to be leased than bought outright.

Chromite has been found in quantity in Pennsylvania, Maryland, North Carolina, and California; but for the last few years, on account of the low price at which foreign chromite ores can be imported into this country, there has been but little mining undertaken in the United States for these ores. This does not mean that the deposits of chromite are exhausted, but that on account of their distance from points of consumption and of the cost of transportation they can not compete with foreign ores. As, however, new uses for chromite may arise nearer to where the deposits are located, they will undoubtedly again become producers of this mineral. For example, the use of chromite for linings of furnaces for the smelting of copper and other ores should produce a demand for the California and the North Carolina chromite ores.

In California chromite deposits of some extent have been located in the following counties: Alameda, Calaveras, Del Norte, Fresno, Mendocino, Napa, Placer, San Luis Obispo, Santa Clara, Shasta, Sierra, Sonoma, and Tehama. Serpentine and other basic magnesian rocks occur very extensively in these counties, and it is probable, if a sufficient demand for chromite arises on the Pacific coast, that prospecting would locate extensive deposits of this mineral.

With the construction of the railroad from Erwin, Tenn., to Marion, N. C., the chromite deposits of Yancey County, N. C., which, from the amount of development work that has been done on them, give indications of containing large deposits of this mineral, should be mined profitably. Analyses of the ore show it to contain a high percentage of chromic oxide, one of them yielding as much as 58 per cent of this oxide. This property is owned by Mr. Garret Ray, of Burnsville, N. C. There is also a promising deposit on Dark Ridge Creek, Jackson County, about 525 feet south of the Dark Ridge trestle of the Murphy Branch of the Southern Railroad. This property is owned by the National Abrasive Manufacturing Company, of Waynesville, N. C. Another property that is at the present time being developed is on Big Ivey Creek, Buncombe County, 16 miles northwest from Asheville, and 9 miles from the railroad. There is on this property considerable chrome sand which can be readily concentrated, and which, as reported, contains 54.09 per cent of chromic oxide. The rock ore, as analyzed, contains 45.78 per cent chromic oxide.

FOREIGN LOCALITIES.

By far the greater part of the chromite used in the United States is obtained from the deposits of Asiatic Turkey, and is brought directly by steamer to this country. These are probably the most extensive chromite mines now in operation, and they furnish the larger part of the chromite supply of the world. The ores usually carry from 50 to 52 per cent of chromic oxide.

The New Caledonia deposits are beginning to be worked to some considerable extent. The ore is, as a rule, shipped from Numea to Australian ports, and thence to Europe as ballast in ships laden with wool; from there some of it is reshipped to this country. It is very probable, however, that steamers will load at Numea and come directly to this country.

The Canadian chromite deposits in the Black Lake region of the Province of Quebec are still producing, and a certain amount of the ore is exported to the United States. The deposits at Bluff Head, on Port au Port Bay, on the west coast of Newfoundland, have been mined but very little during 1901—mainly on account of the short season available for mining and shipping, but also because of the difficulty in shipping the ore, which has to be loaded on the steamers and sailing vessels by means of scows and dories.

VALUE.

The value of chrome ore depends upon its percentage of chromic oxide, Cr_2O_3. The standard ore contains 50 per cent of this oxide, and there is an increase in value of 75 cents to $1 per ton for every unit above 50 per cent, and a much greater deduction for every unit below 50 per cent. The value of the ores is increased by having a low percentage of silica; and even when they are as low as 45 per cent in chromic oxide they find a ready market if they are also low in silica.

PRODUCTION.

Since 1896 there had been little or no production of chromite in the United States, beyond a few tons mined for experimental purposes, until 1900, when there were produced in California 140 long tons, valued at $1,400, and in 1901, when there was a production of 368 long tons, valued at $5,790. In the following table is given the production of chromite in the United States since 1885:

Production of chromite from 1885 to 1901, inclusive.

Year.	Quantity.	Value.
	Long tons.	
1885	2,700	$40,000
1886	2,000	30,000
1887	3,000	40,000
1888	1,500	20,000
1889	2,000	30,000
1890	3,599	53,985
1891	1,372	20,580
1892	1,500	25,000
1893	1,450	21,750
1894	3,680	$53,231
1895	1,740	16,795
1896	786	6,667
1897		
1898		
1899		
1900	140	1,400
1901	368	5,790

It is not at all improbable that the next year or two will see a considerable production of chromite, if the use of this mineral in furnaces becomes common.

IMPORTS.

Most of the chrome ore that is imported into the United States comes from Turkey, with smaller amounts from New Caledonia and Canada. Until 1884 there was little or no chrome ore imported, but the chromate and bichromate of potash and chromic acid were imported on a large scale. Since then, however, the importation of chrome ore has increased, until now it far exceeds in value the amount of chromium salts imported. The amount and the value of chrome ore, chromate and bichromate of potash, and chromic acid imported and entered for consumption in the United States since 1867 are given in the table below:

Chromate and bichromate of potash, chromic acid, and chrome ore imported and entered for consumption in the United States, 1867 to 1901, inclusive.

Year ending—	Chromate and bichromate of potash.		Chromic acid.		Chrome ore.		Total value.
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	
June 30—	*Pounds.*		*Pounds.*		*Long tons.*		
1867	875,205	$88,787	....	....	....	....	$88,787
1868	777,855	68,634	....	....	....	....	68,634
1869	877,432	78,288	....	$3	....	....	78,291
1870	1,235,946	127,333	....	8	....	....	127,341
1871	2,170,473	223,529	....	5	....	....	223,534
1872	1,174,274	220,111	514	49	....	....	220,160
1873	1,121,357	178,472	922	276	....	....	178,748
1874	1,387,051	218,517	44	13	....	....	218,530
1875	1,417,812	183,424	45	22	....	....	183,446
1876	1,665,011	175,795	120	45	....	....	175,840
1877	2,471,669	264,392	13	10	....	....	264,402
1878	1,929,670	211,136	32	35	....	....	211,171
1879	2,624,403	221,151	....	....	....	....	221,151
1880	3,505,740	350,279	5	3	....	....	350,282
1881	4,404,237	402,088	124	89	....	....	402,177
1882	2,449,875	261,006	52	42	....	....	261,048
1883	1,990,140	208,681	290	338	....	....	209,019
1884	2,593,115	210,677	....	120	2,677	$73,586	284,383
1885	1,448,539	92,556	....	39	12	239	92,834
December 31—							
1886	1,985,809	139,117	....	101	3,356	43,721	182,939
1887	1,722,465	120,305	....	5,571	1,404	20,812	146,688
1888	1,755,489	143,312	....	281	4,440	46,735	190,328
1889	1,580,385	137,263	....	2,974	5,474	50,782	191,019
1890	1,304,185	113,613	....	634	4,353	57,111	171,358
1891	755,254	55,897	634	203	4,459	108,764	164,864
1892	496,972	94,055	772	204	4,930	55,579	149,838
1893	976,706	78,981	3,708	641	6,354	58,629	138,251
1894	1,483,762	125,796	5,680	837	3,470	38,364	164,997
1895	2,045,910	181,242	2,083	414	5,230	82,845	264,501
1896	952,794	80,538	2,429	387	8,669	187,400	268,325
1897	1,329,473	108,497	71,220	5,457	11,570	187,439	301,393
1898	1,160,710	86,134	5,329	1,758	16,304	272,234	360,126
1899	1,130,965	73,510	33,134	6,360	15,793	284,825	364,695
1900	111,761	7,758	35,452	7,232	17,542	305,001	319,991
1901	430,996	29,224	53,462	10,861	20,112	363,108	403,193

MONAZITE.

By Joseph Hyde Pratt.

INTRODUCTION.

The monazite industry of the United States, which was nearly at a standstill from 1896 to 1900, has again been revived and is now a small but thriving industry in North Carolina. Considerable attention has been given to the North Carolina and the South Carolina deposits by German manufacturers who wish to obtain deposits of the mineral. Although the actual amount of this mineral used per year has perhaps increased but little, yet there is an increased demand for Carolina monazite on account of the Brazilian monazite sand deposits having, in large measure, come under a single control with the result that the price has advanced. There is, therefore, in Germany a demand for a supply from other sources.

This mineral is essentially an anhydrous phosphate of the rare earth metals, cerium, lanthanum, and didymium (Ce, La, Di) PO_4. There is nearly always present a varying but small percentage of thoria (ThO_2) and silicic acid (SiO_2), which are very probably united in the form of a thorium silicate ($ThSiO_4$). Some monazites contain but a fraction of a per cent of thoria, and some have been analyzed that showed none; others have been recorded that showed the presence of 18 to 32 per cent; but the majority contain from 3 to 9 per cent of this oxide. It is the presence of the thorium oxide that gives the monazite its commercial value. The analysis occasionally shows also the presence of other constituents, as the yttrium and erbium oxides, zirconia, alumina, magnesia, lime, iron oxides, manganese oxide, and titanium oxide.

Monazite is light yellow, honey yellow, reddish, brownish, or greenish yellow in color, with a resinous to vitreous luster, and is translucent to subtransparent. It is brittle with a conchoidal to uneven fracture, and is from 5 to 5.5 in hardness. It crystallizes in the monoclinic system, and some crystals have been observed that were 2 inches in length. The more perfect crystals are, however, very small, ranging from an eighth to a sixteenth of an inch in length down to microscopic ones.

The mineral is usually readily recognized after a few samples have been examined. Its color, usually yellowish inclined to reddish, its hardness, 5 to 5.5, being readily scratched by feldspar (hardness 6) or quartz (hardness 7), and its high specific gravity, 4.64 to 5.3, are the chief macroscopic properties that will aid in distinguishing it. The principal chemical and blowpipe reactions that can be readily employed to identify monazite are the following: It is incompletely soluble in hydrochloric acid, but is completely and readily acted upon by sulphuric acid. If oxalic acid is added to the very dilute filtered sulphuric acid solution, or to the solution obtained by fusing the mineral with soda, and if the mass be treated with water and the residue filtered and dissolved with hydrochloric acid, a precipitate is obtained which upon ignition becomes brick red, due to cerium oxide. Before the blowpipe the mineral turns gray, but is infusible. If heated with sulphuric acid, it colors the flame bluish green, due to phosphoric acid.

OCCURRENCE AND LOCALITIES.

Monazite is found very widely distributed as an accessory constituent in varying proportions of many granites and their derived gneisses. Thus it has been found in the porphyritic, granulitic, and schistose gneisses of the Maritime Mountains of Brazil, extending for a distance of 300 miles through the provinces of Bahia, Minas-Geraes, Rio de Janeiro, and São Paulo;[a] and in the granitic mica-gneisses and hornblende-gneisses of the South Mountain region of North Carolina, covering an area of some 2,000 square miles in McDowell, Burke, Rutherford, Cleveland, Polk, Catawba, Lincoln, and Gaston counties, and extending into Spartanburg and Greenville counties, S. C.[b] Although occurring in but small quantity, it has been identified in the granites or gneisses of Maine, New Hampshire, Massachusetts, Rhode Island, Connecticut, New York, North Carolina, South Carolina, and Georgia. In North Carolina there are a number of mica-schists that carry monazite, as that near the Deake mica mine, Mitchell County, and at Milholland's mill, Alexander County.

The commercial deposits of monazite are not in the original rocks, for they contain but a fraction of a per cent of this mineral; but they are found in the placers of the present streams and rivers, and in the old sand and gravel deposits of former streams. Thus by the decomposition and disintegration of these crystalline rocks, which has proceeded to considerable depths in the Southern States, and by erosion the constituents of these rocks are deposited in the stream beds, the heavier minerals being deposited first and nearer where they originated. We should have, therefore, the richer deposits of monazite in the placer gravels or sands that are found nearest the original rocks, and such deposits occur in North Carolina and South Carolina. The Brazilian deposits occur as beach sea sands, and their concentration has been brought about by the action of the waves.

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[a] Am. Jour. Sci., 3d series, Vol. XXXVII, 1889, p. 109.

[b] Bull. North Carolina Geol. Survey No. 9, p. 27.

The workable deposits of monazite sand occur in Burke, McDowell, Rutherford, Cleveland, and Polk counties, N. C., and in the northern part of Spartanburg County, S. C., and are found along streams that have their sources in the South Mountains. These are Silver, South Muddy, and North Muddy creeks, and Henrys and Jacobs forks of the Catawba River, in McDowell and Burke counties; the Second Broad River and its tributaries in McDowell and Rutherford counties; and the First Broad River and its tributaries in Rutherford and Cleveland counties, N. C., and Spartanburg County, S. C. Associated with the monazite in these sand deposits is zircon, which is always present, and the following, which are the usually associated minerals: Garnet, ilmenite, magnetite, rutile, xenotime, staurolite, cyanite, and titanite (sphere).

Monazite has also been found in the gold placer deposits of The Glades, Hall County, Ga., and is reported to have been found in the gold placers of Orofino, Idaho.

Monazite has also been found in pegmatitic dikes, when it is apt to be in large crystals, the largest that have been found being in an occurrence of this type. In the pegmatitic dikes of southern Norway, which have been mined for feldspar, monazite has been found in crystals and masses of size sufficient to be readily picked out by the miners while sorting the feldspar. There has probably never been over a ton per year shipped from this locality.[a] In a pegmatitic dike at Mars Hill, Madison County, N. C., rough crystals of monazite have been found up to 1½ inches in length.

MINING MONAZITE.

The monazite is obtained by sluicing the sands and gravels, just as placer gold is washed. The resulting concentrates are dried, and magnetite, ilmenite, etc., are separated by means of the electro magnet. Even with very careful washing all the rutile, garnet, etc., can not be eliminated, so that the commercial sand is not pure monazite, but contains from 70 to 90 per cent of this mineral. Of course the percentage of thoria in the sand depends upon the amount of monazite, and as the value of the sand increases with the percentage of this oxide, it is to the producer's advantage to make his sand as high in monazite as possible. There are many small producers in North Carolina who carry their sand through only one sluice box, and, when the concentrates are dry, remove what they can with a hand magnet. All this material is bought and treated again, giving a cleaner product, before it is sold to the consumers.

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[a] U. S. Consular Reports, No. 179, Aug., 1895, Vol. XLVIII, p. 550.

One company is erecting a mill near Shelby, Cleveland County, N. C., to treat the saprolitic rock containing monazite. They claim that they can get a purer product than from the placer deposits. It will be interesting to watch the work of this plant in order to ascertain whether the decomposed gneisses can or can not be treated profitably.

The percentage of thoria that has been reported in concentrates from various localities in North Carolina are given in the following table:

Percentage of thoria (ThO_2) in North Carolina monazite sand.[a]

[Per cent.]

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
ThO_2	2.15	2.25	6.54	1.27	6.30	2.48	5.87	6.26	3.98	1.93

1. White Bank gold mine, Burke County.
2. Hall Creek, Burke County.
3. Linebacher place, Silver Creek, Burke County.
4. Long Branch, McDowell County.
5. Alexander Branch, McDowell County.
6. MacLewrath Branch, McDowell County.
7. Proctor farm, near Bellwood, Cleveland County.
8. Wade McCurd farm, Carpenters Knob, Cleveland County
9. Davis mine, near Mooresboro, Cleveland County.
10. Henrietta, Rutherford County.

The monazite concentrates obtained from working the saprolitic gneisses are said to contain 7.01 per cent of thoria. Sand is reported to have been obtained in Burke County that contains 7.28 per cent of thoria.

As is seen from the above, there is a wide variation in the percentage of thoria in the commercial monazite sands. This percentage can be in many cases very materially raised by more careful washing of the gravels, and by using the electro-magnet in the separation of the iron minerals.

In some instances the monazite deposits contain more or less gold, so that they can be worked for this metal, the monazite being left as a valuable by-product.

USES.

The economic value of monazite is dependent upon the oxides of the rare earths (cerium, lanthanum, didymium) and of thorium which it contains, the latter being utilized with much smaller quantities of lanthanum and didymium in the manufacture of the cylindrical hood or mantle of the Welsbach and other incandescent gaslights. The cerium oxalate obtained in the separation of the rare earth oxides is used in pharmacy.

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[a] Bull. North Carolina Geol. Survey, No. 9, p. 21.

PRODUCTION.

Monazite has been produced chiefly in North Carolina, with a smaller amount in South Carolina, and the product amounted in 1901 to 748,736 pounds, valued at $59,262, as compared with 908,000 pounds, valued at $48,805, in 1900. This is an increase of $10,457 in the value of the monazite produced, but a decrease of 159,264 pounds in the production of the sand. This increase in the value per pound of the monazite is partly due to an increase in the price of the sand, but it is also partly due to the fact that the production reported is from sand that is cleaner and therefore higher in thoria. It is very probable that the actual thoria contents of the sand produced in 1901 equaled if they did not exceed the thoria contents of the sand produced in 1900. The price received by the original miner has increased from 3½ to 5 cents per pound, but the further cleaning process to which this material has been subjected has raised its value to 8 cents per pound. Burke and Cleveland counties, N. C., have furnished the larger proportion of this production, with smaller amounts from McDowell and Rutherford counties.

In the following table is given the production and the value of monazite mined in the United States from 1893 to 1901.

Production of monazite in the United States from 1893 to 1901.

Year.	Quantity.	Value.
	Pounds.	
1893	130,000	$7,600
1894	546,855	36,193
1895	1,573,000	137,150
1896	30,000	1,500
1897	44,000	1,980
1898	250,776	13,542
1899	350,000	20,000
1900	908,000	48,805
1901	748,736	59,262

Prior to 1893 there were a few tons a year shipped from different points, but the exact amount is not known. In 1887 the first monazite was shipped from North Carolina, amounting to 24,000 pounds, and was obtained from Brindletown Creek, Burke County. By 1893 the monazite industry was well established and continued to increase very rapidly until 1895, when 1,573,000 pounds were produced, valued at $137,150. It was at this time that the Brazilian deposits began to be worked, and they at once affected the production in the United States, which dropped to 30,000 pounds. In 1898 the industry began to revive, and since then it has gained steadily every year, until once more it seems to be firmly established.

A number of representatives of German manufacturers have been in North Carolina during the last few months (December, 1901–February, 1902) investigating the monazite field with a view to purchasing deposits. One tract of 353 acres is reported to have been bought near Ellenboro, Cleveland County. Everything taken into consideration, there should be a considerable increase in the production of this mineral in 1902 over that of 1901.

STRONTIUM ORES.

By Joseph Hyde Pratt.

INTRODUCTION.

During the last year there has been considerable interest awakened in the occurrence of strontium minerals, and a number of inquiries have been received regarding localities where these minerals are to be found. The two minerals that are sources of strontium salts are celestite and strontianite.

Celestite, a strontium sulphate, is a highly crystalline mineral with vitreous luster, inclining to pearly, and perfect prismatic cleavage. It is a heavy, white mineral, with sometimes a faint bluish tinge and sometimes a reddish tinge. It has a specific gravity of 3.95 to 3.97, and a hardness of 3 to 3.5. Its chemical composition is represented by the formula $SrSO_4$, and many celestites have been found that are practically pure strontium sulphate. Calcium is often present in small quantities, and barium to a less extent, these elements being isomorphous with the strontium.

Strontianite is a carbonate of strontium and commonly occurs in crystals and crystalline masses of a white to very pale-green color; also occasionally gray, yellow, and yellowish brown. It is brittle, has a nearly perfect prismatic cleavage, and a hardness of 3.5 to 4. Its high specific gravity—3.68 to 3.71—is very noticeable. The chemical composition of this mineral is represented by the formula $SrCO_3$, but there is more or less barium and calcium isomorphous with the strontium, just as there is in the celestite.

These minerals are readily determined before the blowpipe, both giving a crimson flame, due to strontium, and after intense ignition the ignited mineral gives an alkaline reaction when placed on moistened tumeric paper. Celestite fuses readily, and when fused on charcoal with a mixture of sodium carbonate and charcoal powder and transferred to a piece of moistened silver it gives a dark stain of silver sulphide, showing the presence of a sulphate in the mineral. Strontianite, when treated with dilute hydrochloric acid, readily effervesces, showing the presence of a carbonate.

USES.

It is not the metal strontium that is used commercially, but its salts. Those that are most in demand are strontium oxide and strontium hydroxide, which are used in refining beet sugar and also in the defecation of sugar contained in molasses. In general, the method of manufacture of strontium hydroxide is by converting the sulphate into sulphide, bringing this sulphide into solution in water, and precipitating the strontium hydroxide by means of sodium hydroxide (caustic soda). Strontium nitrate ($SrNO_3$), and to a less extent the carbonate ($SrCO_3$) and the oxalate (SrC_2O_4), are used in pyrotechnics for red fire. The iodide, bromide, and lactate of strontium are used in very small quantities in medicine. There are, of course, a large number of other strontium salts that are made and used in the chemical laboratory.

OCCURRENCE.

Celestite is the principal source of these strontium salts, and to a less extent strontianite. Of these two the latter is the more valuable, as it is more readily converted into the strontium salts that are desirable commercially. The strontianite is very much rarer in its occurrence than the celestite, and is therefore mined in but comparatively small quantity. Celestite and strontianite are commonly found associated with limestones, and sometimes with sandstones, and celestite is occasionally found in small quantity associated with metalliferous ores. Celestite has also been found in quantity associated with beds of gypsum, sulphur, rock salt, and clay, one of the most notable occurrences of this type being associated with the sulphur deposits near Girgenti on the island of Sicily.

Nearly all the strontium salts used in the United States are imported from Germany. The German manufacturers derive their strontium minerals in part from Westphalia, Germany, where considerable quantities of strontianite are found, also from Thuringia, Germany, and from Sicily, where celestite occurs abundantly.

In the United States both celestite and strontianite have been found at a number of widely separated localities, but only in a few places has the occurrence given promise of containing the mineral in quantity. Perhaps the most noted locality is near Put in Bay, on Strontian Island, Ottawa County, Ohio. Celestite was first found in 1897 near the center of the main part of the island during the sinking of a well, the walls of which caved in, exposing a cavern in limestone. Further exploration showed this to be in the shape of a horseshoe, 18 by 60 feet. The floor of the cave is about 32 feet below the surface, and is composed of celestite, as are also the walls and ceiling. Mr. Gustav Heinemann, the owner, reports that the celestite extends in depth for a distance of 22 feet below the floor of the cave. Tests by drilling have been made at a number of points beyond the boundaries of the cave, but no deposit of this material was encountered, showing that it is not in a vein formation. Traces of strontia were found in the limestone at many points, but it is only in the cave that it has thus far been found in quantity. In opening up this cave about 150 tons of celestite were taken out, 40 tons of which were shipped.

There are a number of localities in New York where strontium minerals have been found in some quantity. In Schoharie County, in the vicinity of Schoharie, both celestite and strontianite have been found in the rather impure limestone underlying the Helderberg rocks. The minerals occur in pockets, and also in thin seams, varying from less than an inch thick to blocks that weighed as much as 25 pounds. This lower limestone could probably be used to advantage in the manufacture of cement, and in this case the strontium minerals would be obtained as by-products and would go far toward paying the expenses of quarrying. They have thus far been found in the greatest quantity in the limestone on the eastern side of the Schoharie River, near the quarries of Mix & Reilly, who are quarrying the Helderberg stone. These strontium minerals have been found in these rocks for about a mile west of the river, but how far they will be found east of the river is not known, as no openings have been made in the limestone in this direction. In Jefferson County celestite and strontianite have been found near Theresa. In the town of Adams, about 2 miles from the village of Adams Center, a deposit of celestite occurs in a vein in Trenton limestone.[a] On the shore of Chaumont Bay, in the town of Brownsville, celestite has also been found in some quantity. Strontianite occurs in the rocks of the Clinton group near Clinton, in Oneida County, N. Y., where it occurs associated with celestite in geodes. The carbonate forms the outer part of the geode, enveloping the sulphate.[b] These nodules and geodes are found not only in the limestone and sandstone beds, but also in the oolitic iron beds of that vicinity. The best examples of this occurrence were found at the old stone quarries near Lairdsville, about 2 miles west of Hamilton College.[c] It has not been definitely determined whether it occurs in commercial quantity, but if it can be obtained as a by-product in quarrying, it is worthy of further investigation.

Near Cedar Cliff, Mineral County, W. Va., there is an occurrence of celestite that attracted considerable attention twelve years ago on account of the variety of crystals that were found and that were described by Dr. George H. Williams.[d] The celestite was exposed by a railroad cut on the land of Mr. John C. Brady, which is on the western slope of Knobly Mountain between the fourth and fifth milestones south of Cumberland, Md., just outside the limits of the State of Maryland.

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[a] Hough's History of Jefferson County, N. Y., 1854.

[b] Am. Jour. Sci., Vol. XIII, 1852, p. 264.

[c] Am. Jour. Sci., Vol. XXIII, 1887, p. 286.

[d] Ibid., Vol. XXXIX, 1890, p. 183.

The railroad cut is nearly a mile in length, and exposed a thickly bedded and nearly horizontal argillaceous limestone, similar to that used at Cumberland and Hancock, Md., for the manufacture of cement. As described by Dr. Williams,[a] "the crystals [of celestite] occur in flattened lenticular cavities or pockets, which vary from a foot to a yard in diameter and from 3 to 7 inches in height. These are confined to only two or three of the many strata which compose the bluff, and apparently represent former concretions. They are now partially empty and partially filled with clay. The celestite crystals adhere to the walls of these cavities or lie unattached in the clay."

These crystals were examined chemically by Dr. W. F. Hillebrand[b] and were found to be almost pure strontium sulphate. The limestone adjacent to these pockets of celestite was also tested for strontium, and was found to contain a considerable per cent of this metal in the form of sulphate, indicating that the rock was strongly impregnated with celestite for some distance. Although this occurrence of celestite was not examined as to its economic value, it is worthy of further investigation to determine its value as a source of strontium, especially in connection with the utilization of the limestone for the manufacture of cement.

There are numerous other localities throughout the United States where strontium minerals have been found, but in most cases they have been obtained in but small quantity. One promising locality is in the vicinity of Burnet, Burnet County, Tex., where celestite is known to occur in some quantity; and another is at Drummond, Drummond Island, Chippewa County, Mich. At Lockport, N. Y.; near Frankstown, Blair County, Pa.; and at Gleneyre, Larimer County, Colo., good crystals of celestite have been obtained; but there is nothing to indicate that the mineral will be found in commercial quantity.

PRODUCTION.

There has been no production of strontium minerals in the United States except the 40 tons that were obtained from Put in Bay, Ohio, in 1897. This product was shipped to Germany for experimental purposes. Although it is very probable that it would not pay to mine celestite for export, yet there should be a considerable profit in mining this mineral to be used by manufacturing chemists in this country in the manufacture of the strontium salts that are now annually imported in considerable quantity.

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[a] Am. Jour. Sci., Vol. XXXIX, 1890, pp. 183 and 184.

[b] Ibid., p. 185.

MAGNESITE.

By Joseph Struthers.

PRODUCTION.

As in previous years, the production of magnesite in the United States has been confined to California, and amounted in 1901 to 13,172 short tons, valued at $43,057, as compared with 2,252 short tons, valued at $19,333, in 1900. The reported production in 1901 consisted of 3,112 short tons of crude magnesite and 4,726 short tons of calcined magnesite, the latter being equivalent to 10,060 short tons of the crude product.

The following table gives the quantity and value of magnesite produced in the United States from 1891 to 1901, inclusive:

Quantity and value of magnesite produced in the United States from 1891 to 1901, inclusive.

Year.	Quantity.	Value.	Year.	Quantity.	Value.
	Short tons.			*Short tons.*	
1891	439	$4,390	1897	1,143	$13,671
1892	1,004	10,040	1898	1,263	19,075
1893	704	7,040	1899	1,280	18,480
1894	1,440	10,240	1900	2,252	19,333
1895	2,220	17,000	1901	13,172	43,057
1896	1,500	11,000			

From the above table will be seen the very large increase in the domestic production of magnesite during 1901. The quantity of magnesite consumed in the United States annually is approximated by combining the domestic production and the importation. During 1901 the consumption amounted to 46,633 short tons, a considerable increase, which resulted from the extensive use of the calcined product as a refractory lining for open-hearth furnaces and converters in the steel industry, as a lining for rotary kilns used in the manufacture of Portland cement, and as a nonconducting covering for boilers, steam pipes, etc., to prevent loss of heat. Magnesite bricks for the refractory lining of furnaces are made in this country by the Fayette Manufacturing Company, at Layton, Pa., and by the Harbison & Walker Company, of Pittsburg, Pa. When crude magnesite (magnesium carbonate, $MgCO_3$) is submitted to the action of sulphuric acid it is decomposed, forming magnesium sulphate and carbon dioxide, but when heated to a high temperature alone magnesia (magnesium oxide, MgO) and carbon dioxide are produced. In the former case magnesium sulphate ($MgSO_4$ $7H_2O$), or Epsom salts, is produced as a by-product, the production of which during 1901 is estimated at 8,000,000 pounds. There is also a considerable quantity of magnesite utilized in the manufacture of carbon-dioxide gas for carbonating mineral waters and other beverages.

The importation of crude and calcined magnesite during 1901 was 33,461 short tons, as compared with 28,821 short tons in 1900, the supply being derived mainly from the island of Eubœa, in Greece, and from Styria, in Austria. The greater part of the consumption of magnesite in the United States is derived from foreign sources.

MINERAL WATERS.

PRODUCTION.

The following report, for the year 1901, includes a greater number of springs than has any previous report, every section of the country showing an increase in the number of springs reporting sales for the year 1901. Not only is there this increase, but all the sections report increased production, with a corresponding increase in the value of the product. The total number of springs on the list for 1901 is 659, an increase of 98 from the list of 1900, which included 561 springs.

The springs added to the list number 119, and those dropped from it 22. Those actually reporting sales for 1901 are 582, an increase of 91 since 1900. Of the remaining springs, numbering 77, there are 27 reporting that no sales were made in 1901. Of the remainder, two-thirds were represented in the figures of the report for 1900, but have not been heard from for 1901. They are estimated for on the basis of their previous reports. The average price per gallon for 1901 is about 13.6 cents per gallon as compared with 12.5 cents in 1900.

Including the estimated figures for the delinquent springs, the total production for 1901 is 55,771,188 gallons, which is an increase over 1900 of 8,212,404 gallons. The value of this product is $7,586,962, an increase of $1,341,790 over the value of the product of 1900.

When the springs actually reporting sales (582 in number) are compared, the following are the figures: In 1901 there were sold 54,733,661 gallons, valued at $7,443,904, an increase of 9,456,666 gallons, and of $1,652,099 in value over the figures for 1900.

When the different sections of the country are compared, we get the results outlined below.

The North Atlantic States show the greatest gain in the number of springs and the greatest gain in production and valuation. There is a net gain of 55 springs for the section, 58 having been added and only 3 being dropped. This leaves the total for 1901 at 249, as compared with 194 in 1900. Of this total, sales for 1901 are reported by 216, as compared with 173 in 1900. The number of gallons reported is

17,576,969, valued at $2,513,085, an increase of 4,232,261 gallons and of $511,479 over the figures for 1900. The 58 springs new to the list of 1901 are as follows:

Maine.—Ticonic Mineral Spring.

Massachusetts.—Abbott's Spring, Beaver Dam Spring, Bodwell Spring, Clark's Ledge Spring, Crystal Spring of Brockton, Deep Rock Spring, Garfield Spring, Highland Spring, Howe Spring, Howland Spring, King Philip Spring, Lakoo Indian Crystal Spring, Lang Moore Spring, Larchmont Spring, Leland Spring of Natick, Magnolia Spring, Milton Spring, Mount Blue Mineral Spring, Mount Orient Spring, Mount Pleasant Spring, Nashoba Mineral Spring, Nemasket Spring, Niagara Spring, Norwood Spring, Pearl Hill Mineral Spring, Puritan Spring, Ravenwood Spring, Sager Spring, Silver Seal Spring, Sunnyside Spring, Swampscott Spring, Trapelo Spring, Valpey Spring, Whitman Spring, Wilbraham Mountain Spring.

Connecticut.—Park Spring.

New Hampshire.—Hale Spring, Toof's Artesian Well.

New Jersey.—Fowler's Artesian Well, Holly Springs, Indian Spring, Washington Mountain Spring, Watchung Spring.

New York.—Breesport Oxygenated Mineral Springs, Chemung Spring, Cherry Valley Lithia Spring, Chloris Mineral Spring, Eureka White Sulphur and Mineral Spring of Saratoga Springs, Fitzsimmon's Spring, Glacier Spring, Iroquois Springs, Mount View Springs, Warner's Natural Mineral Springs.

Pennsylvania.—Ephrata Mountain Crystal Spring, Gray Mineral Spring, Spruce Hollow Mineral Spring.

Rhode Island.—Berry Spring.

The list for the South Atlantic States has been increased by 20 springs, but 3 have been dropped, so that the net gain is 17. The total for the section in 1901 is 106, as compared with 89 in 1900. Sales for 1901 are reported from 88 springs, which is 13 more than were heard from in 1900. The total number of gallons reported sold is 3,172,709, an increase over 1900 of 799,102 gallons; and the value of the product is $547,487, an increase of $107,582. The springs new to the list, 20 in number, are the following:

Florida.—Hampton Spring, Orange City Mineral Spring.

Georgia.—Artesian Lithia Well, Catoosa Springs, Sulpho-Magnesian Lithia Spring, Salt Spring Lithia Well, Siloam Healing Springs.

Maryland.—Vitan Spring.

North Carolina.—Mida Springs, Monroe Lithia Wells, Vade Mecum Springs.

South Carolina.—Edisto Mineral Spring, White Stone Lithia Spring.

Virginia.—Diamond Spring, Erup Mineral Spring, Hume Spring, Palmer's Lithia Spring, Powhatan Spring, O'Connell Lithia Spring.

West Virginia.—Pence Spring.

In the North Central States there is a net gain of 9 springs, 20 having been added to the list and 11 being dropped. The total for the section in 1901 is 162, and of these 147 report sales, 10 more than reported in 1900. As in 1900, this section exceeded the others in 1901 in the total number of gallons sold and in the total value of the product. The number of gallons reported for 1901 is 22,849,998, an increase of 3,170,499 gallons over the production of 1900, and the value is $3,193,365, an increase of $954,104 over 1900. The 20 springs new to the list are as follows:

Illinois.—Abana Spring, Gravel Springs, Macinac Mineral Springs.

Indiana.—Laxine Spring, Shelbyville Lithia Spring, Winona Lithia Spring.

Iowa.—Fry's Mineral Spring, Lake View Medical Spring, White Sulphur Spring.

Kansas.—Sand Spring.

Michigan.—Alma-Bromo Spring, El Cajon Mineral Springs, Andrews Magnetic Mineral Spring, Owosso Mineral Spring.

Missouri.—Magnesia Gusher Spring.

Ohio.—Buckeye Lithia Spring, Knisely Mineral Springs, Magnetic Magnesia Well, Painesville Mineral Spring.

Wisconsin.—Waukesha Imperial Spring.

The South Central States gained 11 springs, but lost 4; so that the net gain for 1901 is 7. The present total for the section is 53, as compared with 47 for 1900, and of these 50 report sales for 1901. The total number of gallons reported is 7,789,809, which is an increase of 1,241,147 gallons over the production of 1900. The value of this product is $414,723, an increase of $25,210. The 11 springs new to the list are the following:

Alabama.—Ingram Lithia Springs, Talladega Springs, York Aperient Well.

Kentucky.—Restora Spring.

Louisiana.—Mandeville Springs.

Mississippi.—Lowe's Well.

Oklahoma.—White Sulphur Spring.

Texas.—Carrizo Springs, Crazy Well, Milford Mineral Well, Peterman Mineral Spring.

There is a gain of 10 springs in the list for the Western States and Territories, that number having been added to the list of 1900. For 1901 the total is 89, as compared with 79 the previous year. Of these, reports of sales have been received from 80, which is 15 more than were heard from in 1900. The number of gallons reported sold in 1901 is 3,344,176, which is an increase from 1900 of 13,657 gallons. The value of the product of 1901 is $775,244, an increase of $53,724. The 10 springs new to the list of 1901 are as follows:

Arizona.—Agua Caliente.

California.—Blairs Mineral Spring, Upper Soda Spring, Witter Medical Springs.

Colorado.—Beulah Springs, Hot Soda Spring of Idaho Springs, Seltzer Mineral Spring.

New Mexico.—Artesian Coyote Mineral Spring.

Oregon.—Sodaville Mineral Spring.

Production of mineral waters in 1901, by States and Territories.

State or Territory.	Springs reporting.	Product.	Value.
		Gallons.	
Alabama	6	35,535	$22,763
Arkansas	6	172,300	55,150
California	45	2,151,686	567,235
Colorado	14	697,150	142,102
Connecticut	12	348,143	47,199
District of Columbia	2	191,500	10,925
Florida	4	33,818	15,954
Georgia	10	284,976	45,521
Illinois	19	508,016	29,640
Indiana	15	222,200	76,380
Iowa	6	125,500	13,125
Kansas	8	91,357	16,341
Kentucky	5	112,250	16,325
Louisiana	2	338,467	74,335
Maine	22	738,969	89,425
Maryland	8	584,500	57,680
Massachusetts	73	7,458,807	391,958
Michigan	28	7,019,168	1,195,614
Minnesota	5	2,916,500	408,810
Mississippi	7	345,457	45,965
Missouri	13	784,330	147,715
New Hampshire	9	858,600	187,900
New Jersey	12	484,800	189,225
New Mexico	7	73,500	13,175
New York	53	5,456,730	1,189,413
North Carolina	9	375,700	42,167
Ohio	18	6,431,410	267,347
Oregon	5	18,440	4,022
Pennsylvania	27	1,892,885	380,519
Rhode Island	4	265,835	16,286
South Carolina	8	118,609	26,346
South Dakota	2	74,670	7,993
Tennessee	5	130,400	19,500
Texas	18	6,651,750	180,503
Utah	2	51,500	13,250
Vermont	5	72,200	21,160
Virginia	41	1,562,781	335,869
Washington	3	79,900	12,010
West Virginia	6	20,825	13,025
Wisconsin	32	4,676,347	1,030,300
Other States[a]	6	276,150	23,732
Total	582	54,733,661	7,443,904
Estimated production of springs not reporting sales	77	1,037,527	143,058
Grand total	659	55,771,188	7,586,962

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[a] The States in which only one spring for each has made a report are included here. These States are Arizona, Idaho, Montana, Nebraska, Oklahoma, and Wyoming.

Production of natural mineral waters from 1883 to 1901.

Year.	Springs reporting.	Quantity sold.	Value.
		Gallons.	
1883	189	7,529,423	$1,119,603
1884	189	10,215,328	1,459,143
1885	224	9,148,401	1,312,845
1886	225	8,950,317	1,284,070
1887	215	8,259,609	1,261,463
1888	198	9,578,648	1,679,302
1889	258	12,780,471	1,748,458
1890	273	13,907,418	2,600,750
1891	288	18,392,732	2,996,259
1892	283	21,876,604	4,905,970
1893	330	23,544,495	4,246,734
1894	357	21,569,608	3,741,846
1895	370	21,463,543	4,254,237
1896	377	25,795,312	4,136,192
1897	441	23,255,911	4,599,106
1898	484	28,853,464	8,051,833
1899	541	39,562,136	6,948,030
1900	561	47,558,784	6,245,172
1901	659	55,771,188	7,586,962

IMPORTS.

The following tables show the imports of mineral waters from 1867 to 1901, inclusive:

Mineral waters imported and entered for consumption in the United States, 1867 to 1901, inclusive.

Fiscal year ending June 30—	In bottles of 1 quart or less.		In bottles in excess of 1 quart.		Not in bottles.		All not artificial.		Total value.
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	
	Bottles.		*Quarts.*		*Gallons.*		*Gallons.*		
1867	370,310	$24,913	3,792	$360	....	$137	....	....	$25,410
1868	241,702	18,438	22,819	2,052	554	104	....	....	20,594
1869	344,691	25,635	9,739	802	1,042	245	....	....	26,682
1870	433,212	30,680	18,025	1,743	2,063	508	....	....	32,931
1871	470,947	34,604	2,320	174	1,336	141	....	....	34,919
1872	892,913	67,951	....	....	639	116	....	....	68,067
1873	35,508	2,326	....	....	355	75	394,423	$98,151	100,552
1874	7,238	691	....	....	95	16	199,035	79,789	80,496
1875	4,174	471	....	....	5	2	395,956	101,640	102,113
1876	25,758	1,899	....	....	....	....	447,646	134,889	136,788
1877	12,965	1,328	....	....	....	22	520,751	167,458	168,808
1878	8,229	815	....	....	....	....	883,674	350,912	351,727
1879	28,440	2,352	....	....	3	4	798,107	282,153	284,509
1880	207,554	19,731	....	....	....	....	927,759	285,798	305,529
1881	150,326	11,850	....	....	55	26	1,225,462	383,616	395,492
1882	152,277	17,010	....	....	....	....	1,542,905	410,105	427,115
1883	88,497	7,054	....	....	....	....	1,714,085	441,439	448,493

Mineral waters imported and entered for consumption in the United States, 1867 to 1901, inclusive—Continued.

Year ending—	Artificial mineral waters.		Natural mineral waters.	
	Quantity.	Value.	Quantity.	Value.
June 30—	*Gallons.*		*Gallons.*	
1884	29,366	$4,591	1,505,298	$362,651
1885	7,972	2,157	1,660,072	397,875
Dec. 31—				
1886	62,464	16,815	1,618,960	354,242
1887	13,885	4,851	1,915,511	385,906
1888	12,752	4,411	1,716,461	341,695
1889	36,494	8,771	1,558,968	368,661
1890	22,328	7,133	2,322,008	433,281
1891	26,700	8,700	2,019,833	392,894
1892	16,052	9,089	2,266,123	497,660
1893	6,086	2,992	2,321,081	506,866
1894	7,753	3,047	1,891,964	417.500
1895	101,115	19,151	2,104,811	506,384
1896	51,108	11,739	2,273,393	551,097
1897			[a]2,942,200	[a]501,684
1898			[a]1,955,723	[a]526,071
1899			[a]2,382,410	[a]663,803
1900			[a]2,485,042	[a]687,874
1901			[a]2,567,323	[a]744,392

[a] Including artificial.

Prior to the year 1873, as the foregoing tables show, the records of the United States Treasury Department did not distinguish natural and artificial mineral waters. From 1873 to 1883, inclusive, the distinction was made, and artificial mineral waters were classified according to the receptacles in which they were imported. For the period including the years 1884 to 1896 this classification seems to have been dropped, but the artificial waters were still kept separate from the natural waters. Since 1896, however, they have not been differentiated. The number of gallons imported has not varied greatly in the last six years, although for three years the value has slightly increased.

EXPORTS.

No record of the exports of domestic natural mineral waters seems to have been kept by the Treasury Department since 1883, and, as shown by the table below, the exports from 1875 to 1883 were comparatively insignificant.

Exports of natural mineral waters of domestic production from the United States.

Fiscal year ending June 30—	Value.	Fiscal year ending June 30—	Value.
1875	$162	1881	$1,029
1876	80	1882	421
1879	1,529	1883	[a]459
1880	1,486		

[a] None reported since 1883.

ORES OF ECONOMIC IMPORTANCE.

By Edmund O. Hovey.

INTRODUCTION.

The accompanying table has been compiled from several authoritative sources,[a] the ores under each metal being arranged in the order of mineral species given in Dana's System of Mineralogy, sixth edition. The percentage compositions given in that work have been adopted and the metallic content has been calculated therefrom where necessary. In a mining region one often hears ores spoken of as running 90 per cent lead, 80 per cent zinc, and so on, when the purest crystallized minerals do not contain such amounts of the metals. The fourth column of this table shows the highest possible percentage of metal in the various ores, and the fifth column indicates the corresponding amounts of metal in the short ton (2,000 pounds) of pure ore. In a few instances the ore is of such variable or uncertain composition that the highest percentage of metal given by actual analysis has been quoted, instead of any theoretical amount. This has been indicated in the table by the use of brackets.

It must be remembered, however, that, with the exception of some ores of iron, tin, and quicksilver (mercury), the metalliferous ores as found in run-of-mine are not pure or unmixed minerals; on the contrary, they are in complex associations with one another. This is especially the case with silver ores (of which there are some thirty varieties, counting rare combinations), and, to a smaller degree, with ores of gold, nickel, antimony, zinc, and some other metals. Often it is the constituent of low ratio but high pecuniary value in these mixed ores that makes the mine worth working; or such a constituent may be the by-product of reduction which makes mining profitable. Furthermore, even with relatively pure ores, the accompanying gangue minerals, for instance quartz, calcite, barite, and fluorite, seldom can be wholly removed by hand-sorting or other means of concentration. These impurities and the unavoidable losses during the processes of reduction make the amount of metal actually won from an ore fall far below its theoretical chemical composition. The principal use of the table is to show the highest possible amount of metal that could be obtained from pure ores.

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[a] Lehre von den Erzlagerstätten, by Richard Beck, Berlin, 1901; Ore Deposits of the United States and Canada, by James F. Kemp, 4th edition, New York and London, 1901; A System of Mineralogy, by Edward S. Dana, 6th edition, New York, 1895.

Percentage of metal contained in ores of economic importance.

Chemical nature.	Kind of ore.	Chemical composition.	Per cent of metal.	Pounds of metal per short ton.	Remarks.
	Aluminum.				
Fluoride	Cryolite	Na_3AlF_6	12.8	256	Used also as a source of sodium and its compounds.
Oxide	Corundum	Al_2O_3	52.9	1,058	Used, however, mostly as an abrasive.
Do	Bauxite	$Al_2O_3.2\,H_2O$	39.1	782	Often furnishes more aluminum through presence of other oxides in the ore. Principal ore.
Silicate	Kaolinite	$2\,H_2O.\,Al_2O_3.\,2\,SiO_2$	20.9	418	
	Antimony.				
Sulphide	Stibnite (gray antimony, antimonite)	Sb_2S_3	71.4	1,428	Chief ore; often with galena.
Oxide	Valentinite (white antimony, senarmontite).	Sb_2O_3	83.3	1,666	
Do	Stibiconite (antimony ocher)	Sb_2O_3	74.5	1,490	Often furnishes more antimony through presence of other oxides. A byproduct in lead smelting.
	Arsenic.				
Metallic	Native arsenic	As	100	2,000	Contains Sb, Ni, Fe, Mn as impurities. Rare.
Sulphide	Realgar	As_2S_2	70.1	1,402	
Do	Orpiment (auripigment)	As_2S_3	61	1,220	
Arsenide	Löllingite	$FeAs_2$	72.8	1,456	Grades into leucopyrite, Fe_3As_4, with As 64.1 per cent.
Sulpharsenide	Arsenopyrite (mispickel)	FeAsS	46	920	Arsenic is obtained also from some nickel and cobalt ores, particularly smaltite and cobaltite.
	Bismuth.				
Metallic	Native bismuth	Bi	100	2,000	Rare.
Sulphide	Bismuthinite (bismuth glance)	B_2S_3	81.2	1,624	
Oxide	Bismite (bismuth ocher)	B_2O_3	89.6	1,792	
Carbonate	Bismutite (carbonate of bismuth)	$3\,BiCO_5+H_6Bi_2O_6+aq$	80.6	1,612	Composition variable.
Silicate	Eulytite	$Bi_4Si_3O_{12}$	75	1,500	Rare.
	Cadmium.				
Sulphide	Greenockite	CdS_2	77.7	1,554	The cadmium of commerce, however, is obtained from cadmiferous sphalerite (zinc blende).
	Chromium.				
Oxide (or chromate)	Chromite (chromic iron)	$FeCr_2O_4$	52.1 (Cr_2O_3=68.0	1,042 1,360)	Often has MgO and Fe_2O_3 replacing the FeO and Cr_2O_3.

	Cobalt.				
Sulphide	Linnæite (cobalt pyrites)	Co_3S_4	57.9	1,158	Proportions variable. Co replaced usually to some extent by Ni, Fe, and Cu.
Arsenide	Smaltite	$CoAs_2$	28.2	564	Grades insensibly into chloanthite, $NiAs_2$.
Sulpharsenide	Cobaltite	CoAsS	35.5	710	
Arsenide	Skutterudite	$CoAs_3$	20.7	414	
Sulpharsenide	Glaucodot	(CoFe) AsS	23.8	476	Proportions variable.
Oxide	Asbolite (earthy cobalt)	Doubtful	Up to 32	640	
Arsenate	Erythrite (cobalt bloom)	$Co_3As_2O_8+8\,H_2O$	29.5	590	
					Cobalt is obtained also from arsenopyrite and chalcopyrite.
	Copper.				
Metallic	Native copper	Cu	100	2,000	Usually contains some silver.
Sulphide	Chalcocite (copper glance)	Cu_2S	79.8	1,596	
Do	Covellite (indigo copper)	CuS	66.4	1,328	
Do	Bornite (peacock ore)	Cu_3FeS_3	55.5	1,110	Often enriched by mechanical admixture of chalcocite.
Do	Chalcopyrite (copper pyrites)	$CuFeS_2$	34.5	690	
Sulphantimonite	Bournonite	$(Pb, Cu_2)_3Sb_2S_6$	13	260	Contains 42.5 per cent lead and 24.7 per cent antimony.
Do	Tetrahedrite	$Cu_8Sb_2S_7$	52.1	1,042	Sb 24.8 per cent. Grades into tennantite, the sulph-arsenite of Cu, containing Cu 57.5 per cent, As 17 per cent.
Sulpharsenite	Enargite	Cu_3AsS_4	48.3	966	As 19.1 per cent. Grades into famatinite, the sulph-antimonite of Cu, containing Cu 43.3 per cent, Sb 27.4 per cent.
Chloride	Atacamite	$CuCl_2.3Cu(OH)_2$	64.5	1,290	Sometimes yields more copper, on account of admixtures.
Oxide	Cuprite (ruby copper)	Cu_2O	88.8	1,776	
Do	Tenorite (melaconite, black copper)	CuO	79.8	1,596	
Carbonate	Malachite (green carbonate of copper)	$CuCO_3.Cu(OH)_2$	57.4	1,148	
Do	Azurite (blue carbonate of copper)	$2\,CuCO_3.Cu(OH)_2$	55.2	1,104	
Do	Chrysocolla	$CuSiO_2+2H_2O$	36.1	722	
					Pyrite and pyrrhotite sometimes contain copper enough to pay for extraction.
	Gold.				
Metallic	Native gold	Au	100	2,000	Usually contains silver, up to 16 per cent. When more than 16 per cent silver is present the alloy is called electrum.
Telluride	Petzite	$(Ag, Au)_2Te$	25.5	510	Proportions variable. This percentage corresponds to ratio Ag : Au=3 : 1.

Percentage of metal contained in ores of economic importance—Continued.

Chemical nature.	Kind of ore.	Chemical composition.	Per cent of metal.	Pounds of metal per short ton.	Remarks.
	Gold—Continued.				
Telluride	Sylvanite	(Au, Ag)Te_2	24.5	490	Proportions variable. This percentage corresponds to ratio Au : Ag=1 : 1. Reported up to 29.35 Au.
Do	Krennerite	(Ag, Au)Te_2 (?)	34.8	696	Composition uncertain. Calaverite, another telluride, has yielded Au 40.92 per cent. Analyses have given from 5.8 per cent to 12.75 per cent Ag.
Sulpho-telluride	Nagyagite	$Au_2Pb_{14}Sb_3Te_7S_{17}$	[12.75	25.5]	
	Iridium.				
Metallic	Iridosmine	Ir Os	[40	800]	Variable.
Do	Platiniridium	Pt Ir			Do.
					Gold is recovered also from pyrite, arsenopyrite, chalcopyrite, stibnite, and sphalerite (blende).
	Iron.				
Oxide	Hematite (specular iron ore, red hematite).	Fe_2O_3	70	1,400	
Do	Martite (a variety of hematite)	Fe_2O_3	70	1,400	Replacing magnetite in Lake Superior region.
Do	Ilmenite (menaccanite)	$FeTiO_3$	47.3	946	Too refractory for use as a source of iron.
Do	Magnetite (magnetic iron ore)	Fe_3O_4	72.4	1,448	
Do	Franklinite	(Fe, Zn, Mn)O.(Fe, Mn)$_2O_3$	44.4	888	An important ore of zinc in northern New Jersey.
Do	Turgite	2 Fe_2O_3—H_2O	66.2	1,324	Often confounded with hematite.
Do	Limonite (bog iron ore, brown hematite).	2 Fe_2O_3—3 H_2O	59.8	1,196	
Do	Göthite	Fe_2O_3—H_2O	62.9	1,258	Often confounded with limonite.
Carbonate	Siderite (spathic iron ore)	$FeCO_3$	48.2	964	
Silicate	Chamosite	FeO, MgO, Al_2O_3, SiO_2, H_2O.	47	940	Uncertain composition. Iron declines to 33 per cent.
Sulphide	Pyrite (iron pyrites)	FeS_2	46.6	932	Contain 53.4 per cent sulphur and are used in the manufacture of sulphuric acid (oil of vitriol). Sometimes treated also for gold content.
Do	Marcasite (iron pyrites, mundic)				
					Pyrites residue (=purple ore) is a commercial source of iron.

	Lead.				
Sulphide	Galena ("lead," lead glance)	PbS	86.6	1,732	Is also a very important source of silver.
Sulphantimonite	Jamesonite (feather ore)	$Pb_2Sb_2S_5$	50.8	1,016	Contains 29.5 per cent antimony.
Do	Bournonite	$(Pb, Cu_2)_3Sb_2S_6$	42.5	850	Copper, 13 per cent; antimony, 24.7 per cent.
Do	Boulangerite	$Pb_3Sb_2S_6$	58.9	1,178	Antimony, 22.8 per cent.
Carbonate	Cerussite (white lead ore)	$PbCO_3$	77.5	1,550	
Chloro-phosphate	Pyromorphite	$3 Pb_3P_2O_8. PbCl_2$	76.3	1,526	
Chloro-arsenate	Mimetite	$3 Pb_3As_2O_8. PbCl_2$	69.5	1,390	
Sulphate	Anglesite (lead vitriol)	$PbSO_4$	68.3	1,366	
	Manganese.				
Oxide.	Franklinite	$(Fe, Zn, Mn)O. (FeMn)_2O_3$	[20.0	400]	Proportions very variable. Important ore of zinc in northern New Jersey; manganese not saved.
Do	Hausmannite	Mn_3O_4	72.5	1,450	
Do	Braunite	$3 Mn_2O_3. MnSiO_3$	63.5	1,270	
Do	Polianite	MnO_2	63.1	1,262	
Do	Pyrolusite	MnO_2	63.1	1,262	Principal source.
Do	Manganite	Mn_2O_3, H_2O	62.4	1,248	
Manganate	Psilomelane	H_4MnO_5 (?)	[58.6	1,172]	Proportions and composition variable.
Oxide	Wad	$MnO_2 + MnO + H_2O$	[69.2	1,384]	Do.
Carbonate	Rhodochrosite	$MnCO_3$	47.8	956	
Silicate	Rhodonite	$MnSiO_3$	41.9	839	
	Mercury (Quicksilver).				
Sulphide	Metacinnabarite	HgS	86.2	1,724	
Selenide	Tiemannite	HgSe	71.7	1,434	
Sulpho-selenide	Onofrite	Hg(S, Se)	83.8	1,676	Calculated for the ratio S : Se = 6 : 1.
Sulphide	Cinnabar	HgS	86.2	1,724	Principal source.
	Molybdenum.				
Sulphide	Molybdenite	MoS_2	60.0	1,200	
	Nickel.				Nickel and cobalt are almost always associated.
Sulphide	Millerite	NiS	64.7	1,294	
Do	Pentlandite	(Fe, Ni)S	22.0	440	
Arsenide	Niccolite	NiAs	43.9	878	

Percentage of metal contained in ores of economic importance—Continued.

Chemical nature.	Kind of ore.	Chemical composition.	Per cent of metal.	Pounds of metal per short ton.	Remarks.
	Nickel—Continued.				
Sulphide	Linnæite	$(Co, Ni)_3S_4$	28.9	578	Proportions variable. This amount calculated for ratio Co: Ni=1:1.
Arsenide	Chloanthite	$NiAs_2$	28.1	562	Grades insensibly into smaltite, $CoAs_2$.
Sulpharsenide	Gersdorffite	$NiAsS$	35.4	708	
Sulphantimonide	Ullmannite	$NiSbS$	27.8	556	
Carbonate	Zaratite	$NiCO_3.2Ni(OH)_2+4H_2O$	46.8	936	
Silicate	Genthite	$2NiO.2MgO.3SiO_2.6H_2O$	22.6	452	*Röttisite*, found in Voigtland, may be essentially the same as this.
Silicate	Garnierite	$H_2(Ni, Mg)SiO_4+aq$	[35.5	710]	Proportions very variable. This amount calculated from highest analysis given by Dana.
Arsenate	Annabergite (nickel ocher)	$Ni_3As_2O_8+8H_2O$	29.4	588	
					The most important nickel ore is pyrrhotite, a sulphide of iron (mostly Fe_7S_8), which sometimes contains more than 5 per cent Ni.
	Palladium.				
Metallic	Native palladium	Pd	100.0	2,000	Always alloyed with Pt, Ir and other metals
	Platinum.				
Metallic	Native platinum	Pt	100.0	2,000	Occurs, however, only alloyed with from 10 to 30 per cent Fe, Ir, Os, and other metals.
	Quicksilver. (See *Mercury.*)				
	Silver.				
Metallic	Native silver	Ag	100.0	,000	Usually alloyed with gold; sometimes with copper.
Antimonide	Dyscrasite	Ag_3Sb	72.9	1,458	Other proportions cause the content of silver to range from 63.9 per cent to 94.1 per cent.
		Ag_6Sb	84.3	1,686	
Sulphide	Argentite	Ag_2S	87.1	1,741	
Telluride	Hessite	Ag_2Te	63.3	1,266	Often contains gold.
Do.	Petzite	$(Ag,Au)_2Te$	42.0	840	Calculated for ratio, Ag : Au=3:1.
Sulphide	Stromeyerite	$(Ag,Cu)_2S$	53.1	1,062	
Telluride	Sylvanite	$(AuAg)Te_2$	13.4	268	Calculated for ratio, Ag : Au=1:1.
Sulphantimonite	Pyrargyrite (dark red silver ore)	Ag_3SbS_3	59.9	1,198	
Sulpharsenite	Proustite (light red silver ore)	Ag_3AsS_3	65.4	1,308	

Sulphantimonite	Stephanite (brittle silver ore)	Ag_5SbS_4	68.5	1,360	
Sulpharsenite	Polybasite	Ag_9SbS_6	75.6	1,512	Copper always replaces some of the silver.
Chloride	Cerargyrite (hornsilver)	$AgCl$	75.3	1,506	
Chlorobromide	Embolite	$Ag(Cl,Br)$	65.1	1,302	Proportions of Cl to Br vary and change the total of silver present.
Bromide	Bromyrite	$AgBr$	57.4	1,048	
Iodide	Iodyrite	AgI	46.0	920	
					Much silver is obtained from galena, and it also occurs in tetrahedrite, sphalerite, pyrite, chalcopyrite, chalcocite, and other minerals in quantities of economic importance.
	Tin.				
Sulphide	Stannite (tin pyrites)	$Cu_2S.FeS.SnS_2$	27.5	550	Proportions vary.
Oxide	Cassiterite (stream tin, wood tin)	SnO_2	78.6	1,572	Principal ore.
	Tungsten.				
Tungstate	Wolframite	$(Fe,Mn)\ WO_4$	60.6	1,212	Grades into hübnerite, $Mn\ WO_4$, with 60.7per cent tungsten.
Do	Scheelite	$CaWO_4$	63.4	1,268	
	Uranium.				
Oxide	Uraninite (pitchblende)	U_3O_8	84.9	1,698	Chief ore.
Do	Gummite	$U_2O_3.3H_2O$	72.7	1,454	
	Vanadium.				
Vanadate	Vanadinite	$3Pb_3V_2O_8+PbCl_2$	10.9	218	
Do	Mottramite	$(Pb,Cu)_3V_2O_8+2H_2(Pb,Cu)O_2$	10.5	210	
	Zinc.				Zinc minerals often are associated with lead ores.
Sulphide	Sphalerite (blende, black jack)	ZnS	67.0	1,340	
Do	Wurtzite	ZnS	67.0	1,340	
Oxide	Zincite	ZnO	80.3	1,606	
Do	Franklinite	$(FeZnMn)O.(Fe,Mn)_2O_3$	[18.6	372]	Variable. Highest analysis recorded by Dana
Carbonate	Smithsonite	$ZnCO_3$	52.0	1,040	
Do	Hydrozincite	$ZnCO_3.2Zn(OH)_2(?)$	60.5	1,210	Composition is uncertain and analyses vary.
Silicate	Willemite	Zn_2SiO_4	58.6	1,172	
Do	Calamine	$H_2Zn_2SiO_5$	54.2	1,084	

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PUBLICATIONS OF UNITED STATES GEOLOGICAL SURVEY.

[Mineral Resources, 1901.]

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